

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

TerreStar Corporation Request
For Temporary Waiver of
Substantial Service Requirements

)
)
)
)
)

File No. _____

ACCEPTED/FILED

SEP 16 2016

Federal Communications Commission
Office of the Secretary

**TERRESTAR CORPORATION REQUEST FOR
TEMPORARY WAIVER OF SUBSTANTIAL SERVICE REQUIREMENTS**

Regina M. Keeney
Stephen J. Berman
Lawler, Metzger, Keeney & Logan, LLC
1717 K Street NW, Suite 1075
Washington, DC 20006
(202) 777-7700

Counsel for TerreStar Corporation

August 12, 2016

EXECUTIVE SUMMARY

In this filing, TerreStar Corporation (“TerreStar”) requests that the Commission temporarily waive the substantial service deadline for its commercial wireless licenses in the 1.4 GHz band until April 23, 2020, and demonstrates that it satisfies the Commission’s waiver standard. By granting this thirty-six month waiver, the Commission would support the development of wireless medical telemetry service (“WMTS”) operations in TerreStar’s licensed spectrum and expand medical telemetry capacity at 1.4 GHz, where these life-critical systems should be able to operate free of interference. WMTS systems remotely monitor patients’ health at hospitals and other health care facilities, enabling early detection of life-threatening developments and significantly enhancing the standard of patient care. With this waiver, the Commission can take an important step toward meeting the demand for additional WMTS spectrum and improving the health care experience for millions of Americans being treated in hospitals and other facilities across the United States.

Under the Commission’s rules, TerreStar, the sole, nationwide licensee in the commercial wireless 1.4 GHz band, must demonstrate substantial service for each of its sixty-four licenses by April 23, 2017. Prior to a financial restructuring in 2010-13, TerreStar intended to develop an innovative, wireless communications system to provide mobile coverage throughout North America using integrated satellite-terrestrial smartphones and other devices. Following financial difficulties and the sale of its 2 GHz MSS spectrum, TerreStar explored plans for the widespread deployment of a high-power 802.16 WiMAX network for smart grid applications. Since TerreStar’s 1.4 GHz frequencies are adjacent to dedicated WMTS spectrum at 1395-1400 MHz and between 1427 and 1431.5 MHz, TerreStar began discussing with WMTS interests in 2014 the coexistence of high-power WiMAX facilities with nearby WMTS systems. WMTS stakeholders

voiced serious concerns that 1.4 GHz WiMAX network would threaten substantial interference to life-critical WMTS applications. As a result of these continuing discussions and in light of technical and market conditions in the 1.4 GHz band, TerreStar has concluded that, rather than WiMAX, commercial medical telemetry operations would be the best and most productive use of its licensed 1.4 GHz spectrum at this time.

TerreStar's planned implementation of WMTS in the commercial 1.4 GHz band would extend medical telemetry services within health care facilities to the unpaired 1.4 GHz band (1390-1392 MHz) and upper 1.4 GHz A+B Blocks (1432-1435 MHz), and establish new medical telemetry services in the lower 1.4 GHz A+B Blocks (1392-1395 MHz). TerreStar is discussing with WMTS vendors and frequency coordinators an approach that would result in extensive WMTS operations in its licensed spectrum. Specifically, TerreStar anticipates that wireless medical telemetry systems both within and outside health care facilities would use the commercial 1.4 GHz band pursuant to spectrum manager leasing arrangements between TerreStar and a mix of health care providers, health care facilities, and wireless medical telemetry equipment manufacturers. To facilitate this secondary market approach, TerreStar would establish a registration and frequency coordination framework similar to the procedures in place today in the dedicated WMTS bands.

Given the unique adjacency of TerreStar's licensed spectrum and the 1.4 GHz WMTS bands and the extraordinary benefits derived from WMTS use of TerreStar's frequencies, this waiver request satisfies the Commission's waiver standard and is in the public interest. TerreStar submits that WMTS use of its spectrum would generate public interest benefits far greater than those from any other presently feasible use of this band. WMTS use of TerreStar's spectrum would increase medical telemetry capacity in the 1.4 GHz band by approximately 67%.

This increased capacity would relieve some of the WMTS spectrum congestion encountered in many areas, enhance the reliability of life-critical WMTS transmissions, foster innovation, and improve the quality of medical care for millions of patients at hospitals and other health care facilities throughout the country. By 2018, WMTS deployments would likely begin in large health care facilities with the most extensive wireless patient monitoring, resulting in substantial near-term public interest benefits. Eventually, TerreStar's newly deployed WMTS footprint would include each of TerreStar's license areas, covering several thousand health care facilities in the United States. In light of these public interest benefits, leading WMTS equipment manufacturers Philips Healthcare and GE Healthcare both support Commission grant of TerreStar's substantial service waiver request (*see* Exhibit A to this request).

In contrast, denial of TerreStar's waiver request would leave TerreStar with little choice but to deploy high-power 802.16 WiMAX smart grid facilities in an effort to satisfy its substantial service requirements. These systems would threaten detrimental interference to a number of services adjacent to or near TerreStar's licensed 1.4 GHz spectrum, including adjacent-band WMTS, Federal/aeronautical telemetry at 1435-1525 MHz, Telemetry service below 1432 MHz, Radio Astronomy at 1350-1400 MHz, and Federal radar systems at 1300-1390 MHz. This potential outcome would be detrimental to the public interest.

WMTS operations in TerreStar's spectrum and the resulting public interest benefits are possible, however, only if TerreStar and its future WMTS partners are provided sufficient time and regulatory certainty to implement this plan. While initial WMTS deployments in TerreStar's spectrum could occur as soon as 2018, a robust, national WMTS build-out would ultimately be necessary to meet the substantial service requirements for each of its 1.4 GHz licenses. WMTS deployment in TerreStar's spectrum would involve several developmental phases, including

expansion of the frequency range of WMTS devices, safety and efficacy testing, equipment certification, and system installation. While the timelines for these respective phases would overlap, altogether these processes would likely take more than three years to complete industry-wide. Given this reality, TerreStar urges the Commission to grant a thirty-six month waiver of the Commission's substantial service deadline for each of its licenses, until April 23, 2020.

TABLE OF CONTENTS

I.	TerreStar and the 1.4 GHz Band.....	3
II.	Existing Wireless Medical Telemetry Service Bands at 1.4 GHz	8
III.	TerreStar Satisfies the Commission’s Requirements for Temporary Waiver of the Substantial Service Deadline for Its 1.4 GHz Licenses	12
	A. WMTS Use of TerreStar’s Licensed Spectrum is Technically and Operationally Feasible and Consistent with the Commission’s Rules	14
	B. Wireless Medical Telemetry Systems Would Use TerreStar’s Licensed 1.4 GHz Spectrum Under Spectrum Manager Leasing Arrangements, Subject to a National Registration and Frequency Coordination Database.....	17
	C. WMTS Use of TerreStar’s Licensed 1.4 GHz Spectrum Would Generate Enormous Public Interest Benefits for Health Care Providers and Millions of Patients Throughout the United States	20
	D. Denial of TerreStar’s Waiver Request Could Lead to Harmful Interference to Services Adjacent to or Near TerreStar’s Licensed 1.4 GHz Spectrum	23
	E. A Thirty-Six Month Waiver of the Commission’s Substantial Service Requirements Would Enable WMTS Use of TerreStar’s 1.4 GHz Spectrum	26
IV.	Conclusion	31
	Exhibit A: Letters of Support	
	Exhibit B: Jarvinian Presentation	

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
TerreStar Corporation Request)	File No. _____
For Temporary Waiver of)	
Substantial Service Requirements)	

**TERRESTAR CORPORATION REQUEST FOR
TEMPORARY WAIVER OF SUBSTANTIAL SERVICE REQUIREMENTS**

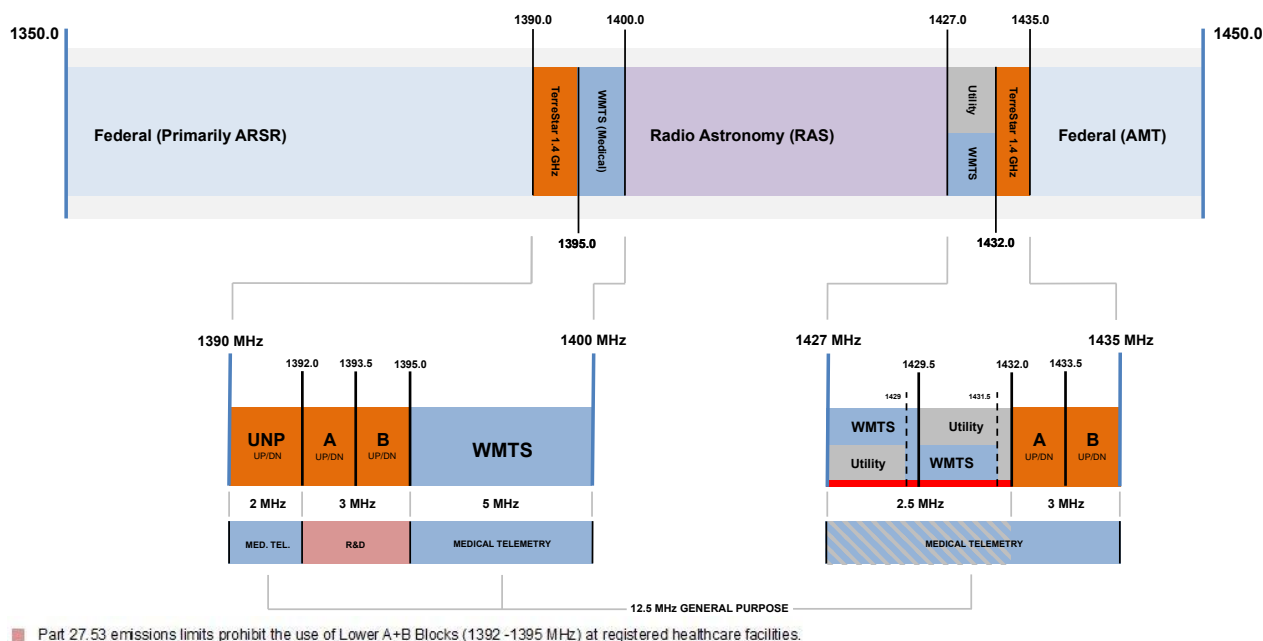
Pursuant to Sections 1.3 and 1.925(b)(3) of the Federal Communications Commission’s (“Commission’s”) rules,¹ TerreStar Corporation (“TerreStar”) hereby requests that the Commission temporarily waive the substantial service requirement for its commercial wireless licenses in the 1.4 GHz band for thirty-six months, until April 23, 2020. As detailed in Section III below, TerreStar satisfies the Commission’s requirements for a temporary waiver of its April 23, 2017 substantial service deadline.

In the past year, TerreStar began discussing with representatives of the wireless medical telemetry service (“WMTS”) industry the potential deployment of WMTS equipment in TerreStar’s licensed 1.4 GHz spectrum. TerreStar’s licensed spectrum is adjacent to already-dedicated WMTS bands and, given technical and market conditions in the 1.4 GHz band, TerreStar submits that WMTS use of its spectrum would generate public interest benefits far greater than those from any other presently feasible use of this band. Use of TerreStar’s spectrum by WMTS would increase medical telemetry capacity in the 1.4 GHz band by approximately 67% (*see* Figure 1). This increased capacity would enhance the reliability of life-critical WMTS transmissions, foster innovation, and improve the quality of medical care for millions of patients at

¹ 47 C.F.R. §§ 1.3, 1.925(b)(3).

hospitals and other health care facilities throughout the country. Given these extraordinary public interest benefits, leading WMTS equipment manufacturers Philips Healthcare and GE Healthcare both support Commission grant of TerreStar’s substantial service waiver request.²

Figure 1: Effective Expansion of 1.4 GHz Medical Telemetry - Using the current and anticipated Part 95 WMTS device ecosystem, a commercial medical telemetry service would expand available 1.4 GHz WMTS capacity from 7.5 MHz to 12.5 MHz (67% increase) nationwide. An additional 3 MHz of spectrum in the Lower A+B Blocks would be made available for medical telemetry on a research and development basis (as discussed *infra*, this spectrum could not be used for WMTS within health care facilities).



WMTS operations in TerreStar’s spectrum are possible, however, only if TerreStar and future WMTS users are provided sufficient time and regulatory certainty to implement this plan. While initial WMTS deployments in TerreStar’s spectrum could occur as soon as 2018 – first targeting major health care facilities with the greatest WMTS use – a robust, national WMTS build-out would ultimately be necessary to meet the substantial service requirements for each of its licenses in this band. As described in this request, WMTS deployment in TerreStar’s spectrum would involve several developmental phases, including expansion of the frequency

² Letters from Philips Healthcare and GE Healthcare supporting TerreStar’s request for temporary waiver of its substantial service requirements are attached to this request at Exhibit A.

range of existing WMTS devices (already being assessed by certain manufacturers), safety and efficacy testing, equipment certification, and system installation. Altogether, these overlapping phases would likely take more than three years to complete. Given this developmental timeline, TerreStar urges the Commission to grant a thirty-six month waiver of the Commission's substantial service deadline, until April 23, 2020.³

I. TerreStar and the 1.4 GHz Band

TerreStar, formerly a licensee in the 2 GHz mobile satellite service ("MSS") band, is currently the sole, nationwide licensee in the commercial wireless 1.4 GHz band. TerreStar holds all sixty-four geographic area licenses and eight megahertz of spectrum in this band at 1390-1395 MHz and 1432-1435 MHz. Specifically, these holdings include six Economic Area Grouping ("EAG") licenses in the 1.4 GHz A Block (1392-1393.5 MHz/1432-1433.5 MHz), six EAG licenses in the 1.4 GHz B Block (1393.5-1395 MHz/1433.5-1435 MHz), and fifty-two Major Economic Area ("MEA") licenses in the unpaired 1390-1392 MHz band.

TerreStar obtained a portion of this licensed spectrum from EchoStar in 2007, and acquired the rest of these licenses in 2008 from CCTV.⁴ TerreStar intended to develop an innovative, wireless communications system to provide mobile coverage throughout North America using integrated satellite-terrestrial smartphones and other devices. While TerreStar did

³ In Exhibit B to this waiver request, TerreStar provides the attached presentation of Jarvinian, consultant to TerreStar on its use of the commercial 1.4 GHz band. This presentation, entitled "Medical Telemetry Use of Commercial 1.4 GHz," addresses issues described in the instant request.

⁴ See Application to Assign Licenses from CCTV Wireless, Inc., to TerreStar License Inc., ULS File No. 0003665274 (Dec. 2, 2008); *Assignment of License Authorization Applications – Action*, Public Notice, Report No. 4584, at 14 (rel. Dec. 10, 2008) (Commission consent to the assignment application); *Assignment of License Authorization Applications – Action*, Public Notice, Report No. 4617, at 19 (rel. Dec. 24, 2008) (consummation of the assignment). The Commission initially assigned licenses in the 1.4 GHz band through its competitive bidding procedures. The Commission's auction of 1.4 GHz license – Auction 69 – was completed on March 8, 2007.

roll out a hybrid satellite-terrestrial service in 2009,⁵ it encountered financial difficulty and filed an initial voluntary petition for Chapter 11 bankruptcy on October 19, 2010. When TerreStar sold its 2 GHz MSS spectrum to DISH Network in June 2011 as part of its financial restructuring, it retained its terrestrial wireless spectrum in the 1.4 GHz band.

Service rules for 1.4 GHz band. In 2002, the Commission established the Fixed and Mobile allocations for the commercial 1.4 GHz band⁶ and adopted service rules for the band.⁷ In its *1.4 GHz Service Rules Order*, the Commission applied its flexible Part 27 regulatory framework, permitting a variety of fixed and mobile services including wireless Internet, high-speed data and other advanced two-way mobile offerings. These rules allow both uplink and downlink operations in the 1.4 GHz band, enabling Time Division Duplexing (“TDD”) operations in this spectrum. With respect to construction requirements, the Commission applied the substantial service criteria contained in Section 27.14(a) of its rules to TerreStar’s 1.4 GHz licenses. Under Section 27.14(a), 1.4 GHz band licensees must demonstrate substantial service in each of their license areas by the end of their ten-year license terms, with substantial service

⁵ Darren Murphy, *TerreStar Genus: AT&T's First Dual-Mode Cellular/Satellite Smartphone*, ENGADGET (Sep. 30, 2009), <https://www.engadget.com/2009/09/30/terrestar-genus-atandts-first-dual-mode-cellular-satellite-sma/> (describing availability of TerreStar's dual-mode satellite-terrestrial smartphone).

⁶ The commercial 1.4 GHz spectrum is allocated to Fixed and Mobile Services (except aeronautical mobile) on a primary basis. *See Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, et al.*, Report and Order and Memorandum Opinion and Order, 17 FCC Rcd 368 (2002).

⁷ *Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, Report and Order, 17 FCC Rcd 9980 (2002) (“1.4 GHz Service Rules Order”).

defined as “service which is sound, favorable and substantially above a level of mediocre service which just might minimally warrant renewal.”⁸

The Commission has not adopted any substantial service “safe harbor” for 1.4 GHz band licensees, in contrast to its approach in the upper microwave bands and other commercial spectrum.⁹ Rather, the Commission stated in the *1.4 GHz Service Rules Order* that it will review licensees’ substantial service showings on a case-by-case basis and “will consider factors such as: i) whether the licensee’s operations service niche markets or focus on serving populations outside of areas serviced by other licensees; ii) whether the licensee’s operations serve populations with limited access to telecommunications services; and iii) a demonstration of service to a significant portion of the population or land area of the licensed area.”¹⁰ The Commission emphasized that this list of factors is not exhaustive, and that licensees can meet their substantial service requirement in other ways. TerreStar’s deadline for demonstrating substantial service is April 23, 2017.

TerreStar’s use of its 1.4 GHz spectrum. Prior to its financial restructuring, TerreStar in September 2009 entered into a spectrum manager lease agreement for its 1.4 GHz spectrum with One Dot Four Corp. (“One Dot Four”), an affiliate of Harbinger Capital Partners. This lease agreement extended through April 2017, with rights to renew for two additional ten-year terms.

⁸ 47 C.F.R. § 27.14(a).

⁹ In other bands, Commission-adopted safe harbors provide wireless licensees with specific minimum requirements for demonstrating substantial service. For instance, in the Local Multipoint Distribution Service (“LMDS”), a licensee deploying point-to-multipoint facilities can meet its substantial service requirement by providing signal coverage to 20% or more of the population of its license area. *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, To Reallocate the 29.5-30.0 GHz Frequency Band, et al.*, Second Report and Order, Order on Reconsideration, and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd 12545, ¶ 270 (1997).

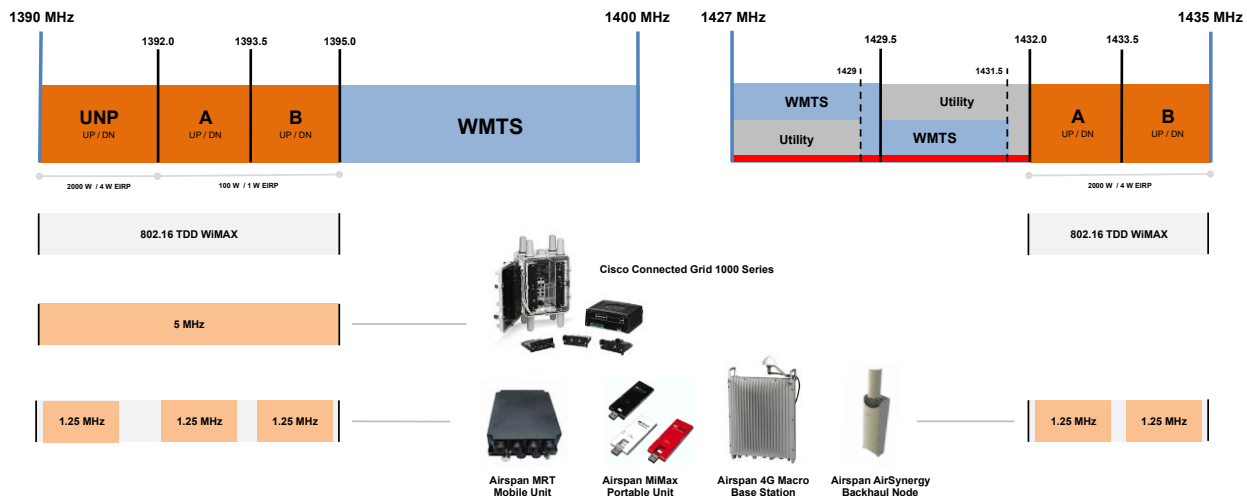
¹⁰ *1.4 GHz Service Rules Order* ¶ 73.

Under this agreement, One Dot Four committed to use the 1.4 GHz band in a manner that would satisfy the Commission’s substantial service requirement for TerreStar’s licenses. This lease was terminated in April 2012 due to non-payment.

In May 2012, TerreStar entered into a spectrum lease arrangement with FirstEnergy Service Company (“FirstEnergy”), a large electrical utility. This lease agreement permitted FirstEnergy to test high-power 802.16 WiMAX facilities for smart grid applications in two EAG license areas in the 1.4 GHz A and B Blocks (1390-1395 MHz/1432-1435 MHz). FirstEnergy’s Smart Grid Modernization Initiative project included deployment of advanced metering infrastructure, distribution automation assets, time-based rate programs, load control, and customer systems in New Jersey, Ohio, and Pennsylvania. TerreStar’s 1.4 GHz spectrum was a critical part of the communications infrastructure for this project, enabling data to be wirelessly transmitted between smart grid systems and pole-mounted concentrators. TerreStar’s lease arrangement with FirstEnergy expired in May 2015.

In February 2014, TerreStar initiated contact with the American Society for Healthcare Engineering (“ASHE”) of the American Hospital Association (“AHA”) and other WMTS industry representatives and vendors (including Philips Healthcare, GE Healthcare, and Comsearch) regarding its plans for the widespread deployment of a high-power 802.16 WiMAX network for smart grid applications (*see* Figure 2). WMTS interests voiced serious concerns that, although a high-power 802.16 WiMAX network might be permitted under existing rules, out of band emissions (“OOBE”) from a 1.4 GHz WiMAX network would threaten substantial interference to life-critical WMTS applications. TerreStar continued discussions with WMTS stakeholders through the end of 2014, during 2015, and in early 2016 in an effort to develop an application for the 1.4 GHz band that would avoid interference to existing WMTS applications.

Figure 2: TDD WiMAX Device and Infrastructure Ecosystem - Significant resources have been deployed to develop and certify a robust smart grid ecosystem using commercial 1.4 GHz spectrum. The WiMAX standard is enabled in this band through Part 27 rules that permit (i) the high OOB associated with 802.16 waveforms and (ii) TDD operation across the upper and lower band segments.



As a result of these discussions and its own internal analysis, TerreStar has concluded that commercial medical telemetry operations would be the best and most productive use of its commercial 1.4 GHz spectrum at this time. Accordingly, in April 2016, TerreStar informed WMTS interests and Federal users in adjacent bands that, pending a substantial service waiver from the Commission, the company would abandon 802.16 WiMAX smart-grid development and use its licensed spectrum for medical telemetry applications. As discussed further below, this plan would extend medical telemetry services within health care facilities to the unpaired 1.4 GHz band (1390-1392 MHz) and upper 1.4 GHz A+B Blocks (1432-1435 MHz), and establish new medical telemetry services in the lower 1.4 GHz A+B Blocks (1392-1395 MHz). TerreStar is currently in discussions with WMTS vendors, frequency coordinators, and ASHE regarding an approach that would result in extensive WMTS operations in its licensed spectrum.

II. Existing Wireless Medical Telemetry Service Bands at 1.4 GHz

TerreStar's licensed 1.4 GHz spectrum is directly adjacent to two primary, dedicated bands for WMTS. Specifically, WMTS operations occur today within (i) a five megahertz band segment at 1395-1400 MHz and (ii) a two and a half megahertz band segment within the 1427-1431.5 MHz band that varies in frequency depending on the location.¹¹ As discussed *infra* Section III.E., the adjacency of WMTS and TerreStar's licensed 1.4 GHz frequencies at 1390-1395 MHz/1432-1435 MHz would enable wireless medical telemetry equipment to operate on TerreStar's commercial wireless spectrum following a waiver grant.

Health care benefits of WMTS. The development of WMTS over the past thirty years has produced important medical benefits for patients in American health care facilities. WMTS systems and devices remotely monitor patients' health at hospitals and other health care facilities, resulting in a significantly improved standard of patient care. WMTS devices measure patients' vital signs and other important health parameters (*e.g.*, pulse and respiration rates) and transmit this data to remote locations, such as a nurses' station. These devices enable early detection of life-threatening developments and conditions so that health care providers can expeditiously provide appropriate treatments. In addition, the untethered nature of WMTS equipment provides patients with greater safety, mobility, freedom, and comfort.¹² Wireless

¹¹ The spectrum at 1427-1431.5 MHz is shared by WMTS devices and non-WMTS facilities such as utility telemetry systems. Generally, WMTS devices have primary status in the 1427-1429.5 MHz segment, while non-WMTS devices have primary status in the 1429.5-1432 MHz segment. There are seven geographic areas, however, where WMTS and non-WMTS status is "flipped" and WMTS devices have primary status in the 1429-1431.5 MHz segment and non-WMTS devices have primary status in the other segments of the band. The seven geographic areas where this "flip" has been implemented include Pittsburgh, PA; Washington, DC; Richmond/Norfolk, VA; Austin/Georgetown, TX; Battle Creek, MI; Detroit, MI; and Spokane, WA. *See 1.4 GHz Service Rules Order* ¶ 26; 47 C.F.R. § 2.106 n.US350.

¹² Among other things, the availability of WMTS at a hospital lowers the risk of patient falls due to tripping hazards attributed to tethered equipment.

monitoring of patients is becoming increasingly important to health care providers seeking to improve the quality of their medical care while controlling costs, and, accordingly, health care providers are using WMTS equipment in an expanding variety of health care settings, including in formerly “non-monitored” areas such as surgical facilities and general wards.

Part 95 regulation and the ASHE database. The Commission established the dedicated 1.4 GHz WMTS band in 2001, adopting service rules in Part 95.¹³ Only eligible health care providers within a health care facility are permitted by the Commission’s rules to operate WMTS devices. Rather than issue individual, exclusive WMTS licenses, the Commission licenses this WMTS band “by rule.” The Commission provided the following explanation for this licensing approach:

Individual licensing is generally designed to give a licensee a protected service area, and thus establishes rights among competing entities in the same service. Operators in the WMTS will not be in competition with each other as are parties in other radio services. The WMTS spectrum will be shared among medical telemetry users, and there will be no mutual exclusivity between users. In addition, “licensing by rule” will minimize regulatory procedures and thus facilitate deployment.¹⁴

Rather than adopt individual licensing procedures, the Commission requires only registration of the location and frequency of operation of WMTS systems with a database administrator. In 2001, the Commission designated ASHE to serve as the exclusive frequency coordinator in the

¹³ *Amendment of Parts 2 and 95 of the Commission’s Rules to Create a Wireless Medical Telemetry Service*, Order, 16 FCC Rcd 4543 (WTB 2001); *see also* 47 C.F.R. §§ 95.1101 *et seq.* The Commission’s Part 95 rules permit bi-directional WMTS data transmissions in the 1.4 GHz WMTS bands, but voice and video transmissions are not permitted in this spectrum.

¹⁴ *Amendment of Parts 2 and 95 of the Commission’s Rules to Create a Wireless Medical Telemetry Service*, Report and Order, 15 FCC Rcd 11206, ¶ 27 (2000) (“WMTS Report and Order”).

WMTS bands at 1.4 GHz (as well as in dedicated WMTS spectrum at 600 MHz).¹⁵ ASHE has contracted with Comsearch to develop and maintain the WMTS database.

Under the Commission's rules, any health care provider who wishes to operate WMTS equipment at a given location must first register and provide the requisite information to ASHE's WMTS database, including manufacturer, model number, location, operating frequency, emission type, effective radiated power, and the health care provider's contact person. In addition to maintaining this database, ASHE reviews and processes WMTS coordination requests submitted by authorized health care providers and notifies WMTS users and equipment manufacturers of potential frequency conflicts.¹⁶ This framework provides health care providers and equipment manufacturers with the information necessary to minimize the risk of inter-WMTS system interference. WMTS users are directed to resolve frequency conflicts themselves, with the Commission's Wireless Telecommunications Bureau making the final decision on any unresolved frequency disputes.¹⁷

Interference protection and importance of the 1.4 GHz WMTS band. Given the life-critical nature of WMTS, it is imperative "to protect the public safety by providing spectrum

¹⁵ *Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service*, Order, 16 FCC Rcd 4543 (WTB 2001).

¹⁶ ASHE must make its services available to all parties on a first-come, first-served, non-discriminatory basis, and must provide access to the WMTS database to all parties seeking such access. WMTS users pay fees to ASHE. *See id.* ¶ 5; *WMTS Report and Order* ¶ 33.

¹⁷ *WMTS Report and Order* ¶ 33. ASHE must also cooperate in exchanging information with Part 90 frequency coordinators and Part 90 licensees with respect to operations in the 1427-1432 MHz band. In particular, ASHE must also provide timely notification to all Part 90 telemetry licensees potentially affected by the deployment of WMTS equipment at a given facility. In addition, ASHE coordinates WMTS operations with radio astronomy observatories and Federal Government radar systems that share the same frequencies. *See* 47 C.F.R. § 95.1113.

where medical telemetry equipment can operate without interference.”¹⁸ In the Commission’s 2002 rulemaking on 1.4 GHz rules, the AHA Task Force stated that “WMTS devices are critical to monitoring patients’ health, so hospitals simply cannot, and will not, tolerate sporadic interference from fixed or intermittent mobile operations using the same, or any adjacent, bands.”¹⁹ Earlier this year in the Commission’s ongoing 600 MHz rulemaking, the WMTS Coalition pointed out that “any loss of WMTS monitoring data presents a real danger to critical care patients being monitored – and potentially for a significant period of time if the interference cannot be quickly resolved.”²⁰ It was in response to “consumer concerns that medical telemetry devices [were] increasingly at risk of harmful interference due to more extensive use of spectrum resources by other applications” that the Commission initiated its WMTS allocation and rulemaking proceedings in the late 1990s, ultimately establishing primary WMTS bands at 1.4 GHz and in the 600 MHz band at 608-614 MHz.²¹

Recent regulatory developments have raised questions, however, about the future viability of wireless medical telemetry operations in the 600 MHz band. While significant WMTS applications have evolved in the six megahertz “safe haven” of unused TV Channel 37 at 608-614 MHz, the introduction of commercial mobile networks in adjacent spectrum and the Commission’s opening of this band to unlicensed service will create a significant threat of interference to these 600 MHz WMTS systems.²² In addition, while some health care facilities

¹⁸ *WMTS Report and Order* ¶ 11.

¹⁹ Initial Comments of American Hospital Association Task Force on Medical Telemetry, WT Docket No. 02-8, at 3 (Mar. 4, 2002).

²⁰ Reply of the WMTS Coalition, ET Docket No. 14-165, at 5 (Mar. 10, 2016) (“WMTS Coalition Reply”).

²¹ *WMTS Report and Order* ¶¶ 1, 11.

²² *See Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and*

use unlicensed 2.4 GHz Industrial, Scientific and Medical (“ISM”) spectrum because this spectrum supports high-bandwidth applications and offers a low-cost ecosystem,²³ ISM spectrum use is subject to extremely high levels of detrimental interference from 802.11-based Wi-Fi operations in the band. Going forward, only the dedicated WMTS spectrum at 1.4 GHz appears suitable for high-priority, life-critical, real-time wireless medical applications.²⁴

III. TerreStar Satisfies the Commission’s Requirements for Temporary Waiver of the Substantial Service Deadline for Its 1.4 GHz Licenses

The Commission can waive its rules “for good cause shown, in whole or in part, at any time.”²⁵ Under the Commission’s wireless service rules, to obtain a waiver of the substantial service requirements in the commercial 1.4 GHz band, a licensee must demonstrate either that the underlying purpose of the substantial service rule would not be served or would be frustrated

Channel 37, and Amendment of Part 74 of the Commission’s Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap, et al., Report and Order, 30 FCC Rcd 9551 (2015) (“*600 MHz Report and Order*”). The WMTS Coalition has argued that the Commission’s “material errors and omissions[,] . . . includ[ing] incorrect assumptions about WMTS system characteristics and the environments in which they operate[,] . . . led to the adoption of significantly smaller separation distances and more relaxed dependability assurance measures than are necessary to ensure that WMTS licensees will not suffer interference from unlicensed devices.” WMTS Coalition Reply at 2. The WMTS Coalition previously stated that the Commission’s interference model in the *600 MHz Report and Order* “will not reflect a realistic assessment of propagation for the environment surrounding a hospital’s most vulnerable areas, thus failing to prevent interference as TV [White Spaces] devices proliferate throughout the areas around the hospitals.” Petition for Reconsideration of the WMTS Coalition, ET Docket No. 14-165, at 8 (Dec. 23, 2015).

²³ In the United States, many medical telemetry systems come with the option of either 1.4 GHz WMTS or 2.4 GHz ISM band transceivers.

²⁴ There is extensive use of this dedicated WMTS spectrum at health care facilities around the United States. For instance, Philips Healthcare manufactures and markets the Philips IntelliVue Telemetry System with advanced smart hopping technology (1.4 GHz), which offers surveillance of ambulatory cardiac patients and maintains seamless connections between the IntelliVue Information Center and telemetry devices. *See IntelliVue Telemetry System: Surveillance and Networking*, Philips, [http://incenter.medical.philips.com/doclib/enc/fetch/2000/4504/577242/577243/577247/582646/583147/PM_-_Philips_Telemetry_System_Brochure_\(US_only\).pdf%3Fnodeid%3D584307%26vernum%3D4](http://incenter.medical.philips.com/doclib/enc/fetch/2000/4504/577242/577243/577247/582646/583147/PM_-_Philips_Telemetry_System_Brochure_(US_only).pdf%3Fnodeid%3D584307%26vernum%3D4).

²⁵ 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

by applying the rule to its case and the requested waiver would be in the public interest, or that, in view of unique or unusual factual circumstances of its case, applying the substantial service rule would be inequitable, unduly burdensome, or contrary to the public interest.²⁶

As demonstrated below, TerreStar satisfies the requirements of Sections 1.3 and 1.925(b)(3)(ii) for a temporary waiver of its April 23, 2017 substantial service deadline.²⁷ TerreStar specifically requests that, for its 1.4 GHz A and B block EAG licenses at 1392-1395 MHz/1432-1435 MHz and its unpaired MEA licenses at 1390-1392 MHz, the Commission temporarily waive its substantial service requirement for thirty-six months, until April 23, 2020.²⁸ Given the unique adjacency of TerreStar's licensed spectrum and the 1.4 GHz WMTS bands and the extraordinary public interest benefits from WMTS use of TerreStar's frequencies, denial of this waiver request would be "contrary to the public interest."²⁹ Following a waiver

²⁶ 47 C.F.R. §§ 1.925(b)(3)(i), (ii). *See generally Applications filed by Licensees in the Local Multipoint Distribution Service (LMDS) Seeking Waivers of Section 101.1011 of the Commission's Rules and Extensions of Time to Construct and Demonstrate Substantial Service, et al.*, Memorandum Opinion and Order, 23 FCC Rcd 5894 (WTB 2008) ("*LMDS Waiver Order*") (waiving and extending the substantial service deadline for LMDS licensees industry-wide, in part to permit the development of LMDS spectrum as backhaul solution for emerging mobile broadband services in the 700 MHz band, Advanced Wireless Services band, and other broadband-capable bands); *ART Licensing Corporation; Requests for Waiver, Extension of Time to Meet Coverage Requirements, and Extension of License Period, et al.*, Order on Reconsideration and Memorandum Opinion and Order, 23 FCC Rcd 14116, ¶ 20 (WTB 2008) (revising the substantial service deadline for FiberTower's 39 GHz licenses, on basis that these licenses were similarly situated to LMDS licenses addressed in the *LMDS Waiver Order*).

²⁷ The Commission has found that Sections 1.3 and 1.925(b)(3) of its rules require "substantially the same showing" from a party seeking a waiver. *See Barry P. Lunderville, College Creek Broadcasting, Inc., and Cumulus Licensing LLC, Petition for Reconsideration, et al.*, Memorandum Opinion and Order, 28 FCC Rcd 665, ¶ 14, n.51 (2013); *Application of Delta Radio, Inc., et al.*, Memorandum Opinion and Order, 18 FCC Rcd 16889, ¶ 7 (2003). *See also Bellsouth Corp. v. FCC*, 162 F.3d 1215, 1225 n.10 (D.C. Cir. 1999).

²⁸ Alternatively, the Commission could grant TerreStar a thirty-six month extension of the April 23, 2017 substantial service deadline pursuant to Section 1.946(e) of its rules. 47 C.F.R. § 1.946(e).

²⁹ *See* 47 C.F.R. § 1.925(b)(3)(ii).

grant, TerreStar's licensed spectrum at 1.4 GHz would be used for wireless medical telemetry applications in hospitals and other health care facilities and environments throughout the United States. The expansion of spectrum resources for WMTS would deliver substantial public interest benefits by improving the quality of medical care for millions of patients throughout the country. Denial of the instant request would forego these enormous benefits. In addition, denial would harm the public interest by leaving TerreStar with little choice but to deploy high-power 802.16 WiMAX facilities in an effort to satisfy its substantial service requirements, systems that would threaten detrimental interference to WMTS and other services in nearby spectrum. The Commission should avoid this harm and instead advance the public interest by expeditiously granting TerreStar's request for a temporary waiver.

A. WMTS Use of TerreStar's Licensed Spectrum is Technically and Operationally Feasible and Consistent with the Commission's Rules

For both practical and regulatory reasons, granting this waiver would enable the efficient deployment of wireless medical telemetry equipment in TerreStar's licensed 1.4 GHz spectrum in health care facilities and other environments throughout the United States. The adjacency of TerreStar's spectrum to dedicated WMTS bands and the existing WMTS ecosystem at 1.4 GHz make WMTS operations technically and operationally feasible in TerreStar's licensed 1.4 GHz spectrum. As designed and manufactured, many WMTS devices have front-end passband filters sufficiently wide that the equipment can operate on spectrum adjacent to the dedicated WMTS spectrum at 1395-1400 MHz and between 1427-1431.5 MHz. Through software or firmware updates, the active frequency range of WMTS equipment can be expanded to include TerreStar's licensed bands at 1390-1395 MHz and 1432-1435 MHz.³⁰ While a WMTS roll-out on a national

³⁰ Specifically, existing WMTS equipment at 1427-1431.5 MHz can be modified via software or firmware update to operate at 1432-1435 MHz, while existing WMTS equipment at

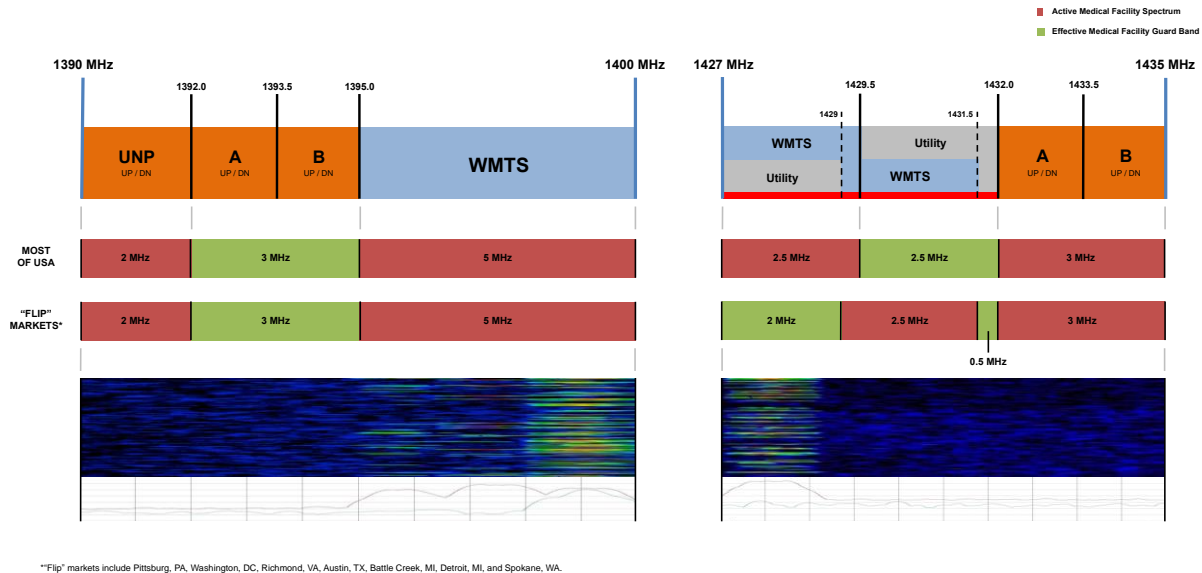
scale would likely take three years or more (as described below), initial WMTS deployments in TerreStar's spectrum could occur in major health care facilities as early as 2018.

The flexibility of the Commission's Part 27 regulatory framework at 1.4 GHz also makes WMTS deployment in TerreStar's 1.4 GHz spectrum feasible because it would require no rule changes. Low-power wireless medical telemetry systems and devices generally would comply with all applicable Part 27 technical rules in the 1.4 GHz band, except in one scenario identified on page 16 below. Under Part 27, health care providers would be able to operate wireless medical telemetry equipment at health care facilities using five megahertz of TerreStar's licensed spectrum at 1390-1392 MHz/1432-1435 MHz. Additionally, there would be sufficient spectral separation between wireless medical operations in TerreStar's spectrum and the dedicated WMTS bands to minimize the risk of mutual interference between Part 27 and Part 95 medical telemetry systems (*see* Figure 3).³¹

1395-1400 MHz can be modified to enable these systems and devices to operate within the 1390-1395 MHz band segment.

³¹ There would be three megahertz of spectral separation between TerreStar's licensed spectrum at 1390-1392 MHz and the WMTS band at 1395-1400 MHz, and two and a half megahertz separation between TerreStar's licensed spectrum at 1432-1435 MHz and the WMTS band at 1427-1429.5 MHz. In the seven "flip" markets (*see supra* n.11 and *infra* at 24), there would be only half a megahertz of separation between the Part 27 and Part 95 spectrum.

Figure 3: Compatibility Between Part 27 and Part 95 Medical Telemetry - Most existing 1.4 GHz WMTS devices would be convertible to commercial 1.4 GHz medical telemetry service in the immediately adjacent band segments. Beyond this hardware compatibility, TerreStar believes that effective channel spacing and flexible Part 27 emissions rules would facilitate both safe co-existence and re-certification of existing medical telemetry equipment.



Although wireless medical telemetry operations are also technically feasible in TerreStar’s lower A and B Block spectrum at 1392-1395 MHz, the Commission’s Section 27.53 emissions and field strength limits preclude the use of this spectrum at health care facilities, to protect WMTS systems above 1395 MHz from interference.³² Given this restriction, TerreStar anticipates that its licensed spectrum at 1392-1395 MHz would be used for developmental and specialized medical telemetry applications outside of health care facilities. These developmental telemetry operations would likely include mobile medical telemetry in ambulances and other vehicles, in-home medical telemetry, rural telemedicine applications, and research and development operations at universities, medical schools, and corporate laboratories.

To ensure the technical viability and long-term efficacy of WMTS operations in its licensed spectrum, TerreStar has collaborated closely with major WMTS manufacturers such as

³² See 47 C.F.R. § 27.804.

Philips Healthcare and GE Healthcare. TerreStar will continue to work jointly with these manufacturers in connection with the requested waiver and future regulatory processes that enhance the utility and safety of WMTS operations at 1.4 GHz. As indicated *supra* at 2, letters from Philips Healthcare and GE Healthcare supporting the requested substantial service waiver are attached to this request at Exhibit A.

B. Wireless Medical Telemetry Systems Would Use TerreStar's Licensed 1.4 GHz Spectrum Under Spectrum Manager Leasing Arrangements, Subject to a National Registration and Frequency Coordination Database

Wireless medical telemetry systems both within and outside health care facilities would use TerreStar's licensed 1.4 GHz spectrum under an operational framework subject to TerreStar's ultimate control. TerreStar anticipates that WMTS operations would occur in its licensed spectrum under spectrum manager leasing arrangements, consistent with the criteria contained in Sections 1.9010 and 1.9020 of the Commission's rules.³³ The terms of these spectrum manager leasing arrangements would promote long-term utilization of TerreStar's licensed spectrum by WMTS systems.

Specifically, to enable a robust deployment of wireless medical telemetry equipment in each of TerreStar's license areas, TerreStar expects to enter into individual spectrum manager leasing arrangements with a mix of health care providers, health care facilities, and wireless medical telemetry equipment manufacturers. Under these spectrum manager lease agreements, TerreStar would retain both *de jure* and *de facto* control of its licensed 1.4 GHz spectrum, as required under the Commission's secondary markets rules and orders.³⁴ TerreStar would be fully responsible for ensuring spectrum lessees' compliance with the Communications Act and all

³³ See 47 C.F.R. §§ 1.9010, 1.9020.

³⁴ 47 C.F.R. §§ 1.9010(b), 1.9020(a); see also *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 20604, ¶¶ 64-70, 100-102 (2003).

applicable policies and rules directly related to the use of its 1.4 GHz spectrum.³⁵ Through lease provisions and actual oversight and enforcement of such provisions, TerreStar would ensure that these spectrum lessees operate in conformance with applicable technical and operational rules for the 1.4 GHz band.³⁶ TerreStar would maintain a reasonable degree of actual working knowledge about spectrum lessees' activities and facilities affecting ongoing compliance with the Commission's rules and policies, and would be responsible for resolving all interference-related matters, including conflicts between its spectrum lessees and any other spectrum lessee or licensee.³⁷ TerreStar would have a reasonable right to inspect spectrum lessees' wireless medical telemetry operations, and it could terminate these spectrum manager leasing arrangements in the event spectrum lessees failed to comply with the terms of these arrangements and/or applicable FCC requirements.³⁸ TerreStar would also be responsible for making any necessary filings with the Commission related to its leased 1.4 GHz spectrum, including the required spectrum manager lease notification.³⁹

Consistent with the Commission's spectrum leasing rules and orders, the spectrum lessees in TerreStar's 1.4 GHz spectrum would be responsible for establishing that they meet applicable eligibility and qualification requirements for these spectrum lease arrangements.⁴⁰ These spectrum lessees would be independently accountable to the Commission for complying

³⁵ 47 C.F.R. §§ 1.9010(b)(1), 1.9020(b)(1).

³⁶ 47 C.F.R. § 1.9010(b)(1)(i).

³⁷ *Id.* § 1.9010(b)(1)(ii).

³⁸ *Id.* § 1.9010(b)(1)(iii).

³⁹ *Id.* § 1.9010(b)(2).

⁴⁰ 47 C.F.R. § 1.9020(c)(2).

with the Communications Act and Commission policies and rules, and would accept Commission oversight and enforcement consistent with TerreStar's 1.4 GHz licenses.⁴¹

To facilitate the WMTS use of its licensed 1.4 GHz spectrum under these spectrum leasing arrangements, TerreStar would implement a national registration and frequency coordination framework similar to the procedures in place today in the dedicated WMTS bands. TerreStar hopes to contract with ASHE and Comsearch to establish and administer this wireless medical telemetry database and registration system in its commercial 1.4 GHz spectrum. Similar to the existing, dedicated WMTS spectrum at 1.4 GHz, health care providers and other spectrum lessees intending to operate wireless medical telemetry equipment in TerreStar's spectrum would register their equipment in TerreStar's commercial 1.4 GHz database, for a reasonable fee. Parties using this equipment within health care facilities (*i.e.*, devices operating in TerreStar's spectrum at 1390-1392 MHz/1432-1435 MHz) would indicate the location of those facilities, and provide such information as manufacturer, model number, operating frequency, emission type, and other relevant technical parameters. Wireless medical telemetry operators using equipment outside health care facilities (including devices operating at 1392-1395 MHz) would specify the location and nature of the operating environment, as well as provide appropriate technical information. TerreStar's database would provide parties with the information necessary to avoid interference between different wireless medical telemetry systems at 1.4 GHz. In the event of frequency disputes between medical telemetry users, TerreStar would work in conjunction with ASHE and Comsearch to determine an appropriate solution to such disagreements.

⁴¹ *Id.* §§ 1.9020(c)(4)-(5).

C. WMTS Use of TerreStar's Licensed 1.4 GHz Spectrum Would Generate Enormous Public Interest Benefits for Health Care Providers and Millions of Patients Throughout the United States

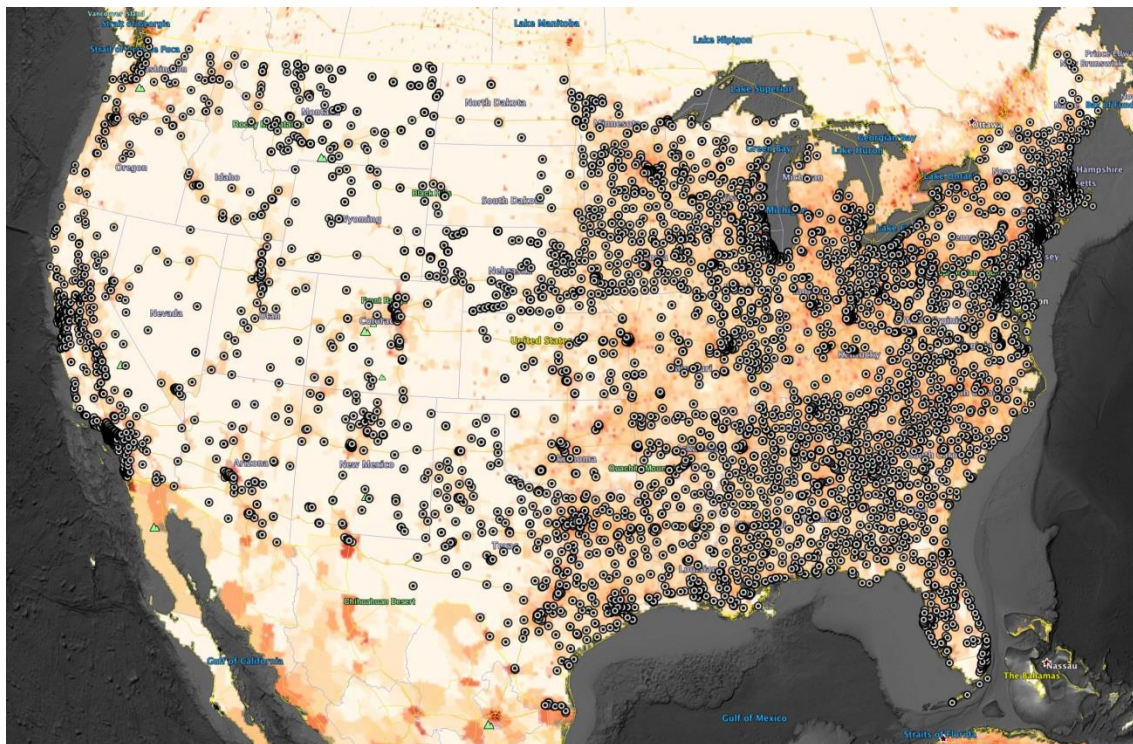
Grant of the requested waiver would advance the public interest by making available five additional megahertz of spectrum for WMTS in hospitals and other health care facilities - a 67% increase in WMTS capacity at 1.4 GHz. Expanded WMTS capacity at 1.4 GHz is crucial because of (i) the continuing growth of wireless patient monitoring at American hospitals and (ii) growing interference concerns at 600 MHz and 2.4 GHz (described *supra* at 11-12) that will spur the migration of additional WMTS systems to the 1.4 GHz band. By enabling WMTS use of TerreStar's spectrum, the Commission can prevent spectrum exhaustion and congestion at hospitals and other health care facilities and ensure the reliability and security of life-critical WMTS transmissions. With this expanded capacity, health care vendors can deploy WMTS systems more effectively and efficiently, reducing patient risk and improving their standard of care. Health care providers would have greater confidence that, in the face of increasing pressure on longstanding WMTS allocations, there will be sufficient spectrum available for these mission-critical wireless medical services.

Millions of patients throughout the United States would benefit from WMTS deployment in TerreStar's spectrum. By 2018, WMTS deployments would likely begin in large health care facilities with the most extensive wireless patient monitoring, resulting in substantial near-term public interest benefits. TerreStar expects that, in some cases, existing WMTS equipment at health care facilities would be upgraded to operate at 1390-1392 MHz and 1432-1435 MHz, while at other facilities the existing WMTS infrastructure might be supplemented with new WMTS equipment capable of operating on these TerreStar frequencies. TerreStar anticipates that, eventually, its newly deployed WMTS footprint would rival the geographic reach of

existing WMTS operations, covering thousands of health care facilities throughout the country.

As shown in Figure 4 below, major health care facilities are widely distributed geographically, extending to every major population center.⁴²

Figure 4: Major Medical Facility Density Across the United States – Overlaid against population density, several thousand major medical facilities represent a large addressable market for commercial medical telemetry.



The developmental use of TerreStar’s lower A and B Block spectrum at 1392-1395 MHz for medical telemetry applications outside health care facilities would also yield substantial public interest benefits. Using medical telemetry devices in mobile settings such as ambulances could produce significant improvements in emergency medical care. In-home medical telemetry at 1392-1395 MHz could provide significant benefits to health care patients, who are

⁴² See *U.S. Health & Human Services - Healthcare Facilities*, U.S. Federal Maps and Apps (May 13, 2016), <http://fedmaps.maps.arcgis.com/home/item.html?id=aafc81b384b647f48b2e52e04986e902>.

increasingly relying on medical treatment in residential environments.⁴³ In addition, research and development of wireless medical telemetry equipment – potentially as dedicated test sites for WMTS – promises to stimulate innovation and the development of new medical telemetry applications. Rural telemedicine applications could benefit patients in rural and remote areas with the greatest need for improved medical care and treatment.⁴⁴

If the Commission denied the instant waiver request and rigidly applied the current April 2017 substantial service deadline to TerreStar’s licensed 1.4 GHz spectrum, it would forego these extraordinary health care benefits for the American public, an outcome that qualifies as

⁴³ As the Commission’s Connect2HealthFCC Task Force states on its website, the U.S. Census indicates that one in five Americans (or approximately 71 million) will be 65 or older by 2030. The Task Force notes that “[w]ith the right support, seniors can continue to live healthy, independently and safely.” While chronic medical conditions such as diabetes, high blood pressure, and heart failure require close follow-up, the Task Force observes that in-home remote monitoring devices combined with online doctor visits can enable patients to stay connected with their doctors and sometimes avoid lengthy commutes to distant facilities. *See Telehealth Offers Tech Tools for Living Independently*, Connect2HealthFCC, FCC, <https://www.fcc.gov/general/telehealth-offers-tech-tools-living-independently> (last visited July 8, 2016).

⁴⁴ The Connect2HealthFCC Task Force is working, among other things, to strengthen the nation’s telehealth infrastructure through the Commission’s Rural Health Care Program and other initiatives. *See The Connect2HealthFCC Task Force*, Connect2HealthFCC, FCC, <https://www.fcc.gov/about-fcc/fcc-initiatives/connect2healthfcc/general/connect2healthfcc-task-force> (last visited July 8, 2016). *See also* News Release, \$22.1 Million to Improve Access to Health Care in Rural Areas, U.S. Department of Health & Human Services (Sept. 26, 2014), <http://www.hrsa.gov/about/news/pressreleases/140926ruralhealth.html> (“Rural communities have some of the greatest needs for expanding access to health care.”); Kavita Patel, Margaret Darling, Kate Samuels, and Mark McClellan, *Transforming Rural Health Care: High-Quality, Sustainable Access to Specialty Care*, Health Affairs Blog (Dec. 5, 2014), <http://healthaffairs.org/blog/2014/12/05/transforming-rural-health-care-high-quality-sustainable-access-to-specialty-care/> (“Health care for patients in rural communities across the United States remains a unique challenge.”); Sarah Klein, *In Focus: Improving the Quality of Rural Health Care Through Collaboration*, Commonwealth Fund (Nov/Dec 2009), <http://www.commonwealthfund.org/publications/newsletters/quality-matters/2009/november-december-2009/in-focus> (describing “the scarcity of rural health professionals” and other impediments to “consistent and comprehensive access to medical care in rural communities”); *see also Rural Health Care Support Mechanism*, Order, 21 FCC Rcd 11111, ¶ 1 (2006) (establishing a pilot program to fund networks “to bring the benefits of innovative telehealth and, in particular, telemedicine services to those areas of the country where the need for those benefits is most acute”).

“contrary to the public interest” under the Commission’s Section 1.925(b)(3)(ii) waiver standard. If required to meet the existing April 2017 deadline, TerreStar would be compelled to pursue the only established application in its spectrum and move forward aggressively with new high-power 802.16 WiMAX smart grid deployments at 1390-1395 MHz/1432-1435 MHz throughout the United States.⁴⁵ These WiMAX facilities at 1390-1395 MHz/1432-1435 MHz would likely threaten harmful interference to WMTS systems and devices operating at 1395-1400 MHz and between 1427 and 1431.5 MHz. Thus, while a waiver would advance the public interest by expanding WMTS capacity and benefiting millions of patients, hospitals, and other health care facilities, denying that waiver would potentially *harm* patients and health care vendors by degrading those life-critical communications.⁴⁶

D. Denial of TerreStar’s Waiver Request Could Lead to Harmful Interference to Services Adjacent to or Near TerreStar’s Licensed 1.4 GHz Spectrum

If the Commission denied TerreStar’s waiver request and TerreStar proceeded with new high-power 802.16 WiMAX smart grid deployments, these operations would threaten harmful interference to a number of other services adjacent to or near TerreStar’s licensed 1.4 GHz spectrum, a result that further weighs against the public interest. These services are identified below.

Federal/aeronautical telemetry at 1435-1525 MHz. Directly adjacent to TerreStar’s spectrum at 1432-1435 MHz, the 1435-1525 MHz band is allocated to Federal/aeronautical telemetry use and is utilized for government/military and commercial flight-test operations.

⁴⁵ As indicated above, FirstEnergy tested these Smart Grid applications under lease arrangements in two EAG license areas in the 1.4 GHz A and B Blocks.

⁴⁶ As indicated *supra* at 6-7, TerreStar has described these potential high-power WiMAX operations to representatives of WMTS manufacturers. The WMTS representatives expressed serious concerns regarding the likelihood of harmful interference from these high-power systems to WMTS applications in hospitals and other medical environments.

Aeronautical telemetry is used to provide critical operational and telecommand data between ground facilities and the aircraft, space vehicle, missile, or weapon systems being tested.⁴⁷

Aeronautical telemetry links above 1435 MHz may occur over virtually any portion of TerreStar's licensed spectrum area. Due to the long-distance nature of these air and space vehicle links, this service must employ high-gain receiver systems that are especially susceptible to adjacent and co-channel interference, including from any future high-power WiMAX operations in TerreStar's 1.4 GHz spectrum.⁴⁸ By implementing a low-power indoor medical telemetry application at 1432-1435 MHz, TerreStar would effectively eliminate the threat of harmful interference to aeronautical telemetry from the commercial 1.4 GHz band.

Telemetry Service below 1432 MHz. There is a primary allocation to the Telemetry Service at 1429.5-1432 MHz in all but seven license areas in the United States, with primary Telemetry operations instead at 1427-1429.5 MHz in the seven areas affected by the band "flip" with WMTS. Telemetry services typically involve meter-reading and remote monitoring and control of critical infrastructure. Telemetry is subject to Part 90 technical and service rules, which were adopted in the Commission's 2002 *1.4 GHz Service Rules Order*.

Utility applications for telemetry services at 1427-1432 MHz typically employ low-power transceivers at many diverse locations (*e.g.*, water utility metering points) that transmit data to a central hub. Such a system may be vulnerable to severe receiver performance degradation from a high-power operation in the immediately adjacent band. In contrast, low-

⁴⁷ Aeronautical telemetry is a life-critical service in many contexts. Flight test telemetry enables ground-based engineers to monitor conditions aboard the aircraft in real time, so as to detect and avert possible threats to the life of the pilot as well as to neighboring communities.

⁴⁸ In the Commission's 1.4 GHz proceeding in 2002, the Aerospace and Flight Test Radio Coordinating Council expressed concern about out-of-band interference from adjacent-band high-power operations at 1432-1435 MHz to flight testing above 1435 MHz. Comments of Aerospace and Flight Test Radio Coordinating Council, WT Docket No. 02-8, at 4-6 (Mar. 4, 2002).

power medical telemetry operations in TerreStar’s spectrum at 1432-1435 MHz would be virtually equivalent to the existing Part 95 WMTS systems that utility applications successfully coexist with today in many markets.

Radio Astronomy at 1350-1400 MHz. Radio Astronomy Service (“RAS”) is a passive radio service used to study celestial objects that emit radio waves. Through radio astronomy, scientists can study astronomical phenomena that are often invisible in other portions of the electromagnetic spectrum. RAS is conducted throughout the 1350-1400 MHz band pursuant to footnote US311 of the Commission’s allocation table. Under this footnote, RAS operations at 1350-1400 MHz are conducted on an unprotected basis, although TerreStar as a 1.4 GHz licensee is required to “make every practicable effort to avoid causing interference” to RAS receivers.⁴⁹

RAS is protected from interference across the 1400-1427 MHz band due to the presence of the 21 cm hyperfine hydrogen line at 1420.405 MHz. However, while radiative hydrogen transitions occur at this frequency, the significant Doppler shifts associated with most astronomical targets of interest mean that radio telescopes often tune outside of their protected band and below 1400 MHz. A medical telemetry application across the 1390-1395 MHz band would significantly reduce the potential for interference to “redshifted” radio astronomy observations at 1350-1400 MHz.⁵⁰

⁴⁹ The Commission declined to impose coordination requirements or exclusion zones on 1.4 GHz licensees to protect RAS in its *1.4 GHz Service Rules Order*. *1.4 GHz Service Rules Order* ¶ 149.

⁵⁰ “Redshifting” is the shift toward longer wavelengths of the spectral lines emitted by a celestial object that is caused by the object moving away from the earth. Because the universe is expanding, a majority of 21 cm hydrogen line radio astronomy observations occur at redshifted frequencies.

Federal Spectrum for radar operations at 1300-1390 MHz. The Federal spectrum at 1300-1390 MHz is predominantly used for Air Route Surveillance Radar (“ARSR”) applications.⁵¹ ARSR radar systems operate simultaneously on two frequencies, each of which has an occupied bandwidth of approximately 1 megahertz. The large unoccupied areas of this band permit ARSR systems to be frequency agile as a countermeasure to jamming by enemy aircraft. While TerreStar does not have access to the receiver performance characteristics of ARSR systems, wireless medical telemetry services would likely represent a far more compatible neighbor to these radar operations than TerreStar’s originally planned high-power WiMAX application.

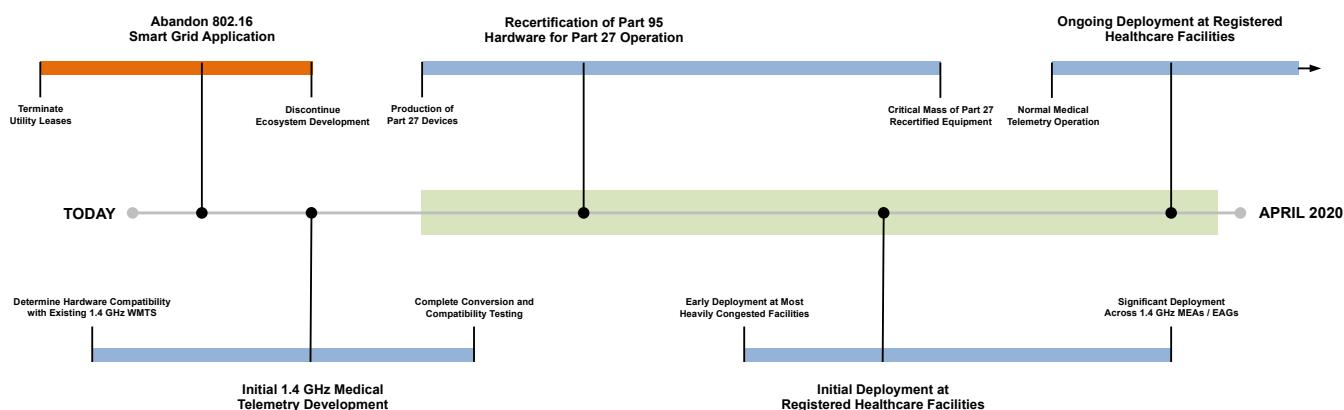
E. A Thirty-Six Month Waiver of the Commission’s Substantial Service Requirements Would Enable WMTS Use of TerreStar’s 1.4 GHz Spectrum

WMTS operations in TerreStar’s 1.4 GHz spectrum and the resulting public interest benefits are possible only if TerreStar and its future WMTS partners have the time – and resulting regulatory certainty – necessary to implement this plan. A robust national WMTS deployment in each of TerreStar’s license areas would require the completion of several complex

⁵¹ The 1300-1390 MHz band has been recommended for reallocation study by the National Telecommunications and Information Administration (“NTIA”). See *Presidential Memorandum – Expanding America’s Leadership in Wireless Innovation*, Daily Comp. Pres. Docs., 2013 DCPD No. 00421, at 1 (June 14, 2013) (“2013 Presidential Memorandum”); Penny Pritzker and Lawrence E. Strickling, *Fifth Interim Progress Report on the Ten-Year Plan and Timetable*, U.S. Department of Commerce (April 2015), https://www.ntia.doc.gov/files/ntia/publications/ntia_5th_interim_progress_report_on_ten-year_timetable_april_2015.pdf; Penny Pritzker and Lawrence E. Strickling, *Sixth Interim Progress Report on the Ten-Year Plan and Timetable*, U.S. Department of Commerce, at 9, 14-15 (June 2016), https://www.ntia.doc.gov/files/ntia/publications/ntia_6th_interim_progress_report_on_ten-year_timetable_june_2016.pdf (identifying the 1300-1390 MHz band as one of the primary recommendations for reallocation). Of the spectrum bands being evaluated by NTIA for reallocation, only the 1300-1390 MHz band (i) falls below 2.5 GHz and (ii) contains a substantial block of spectrum. Moreover, this band features a highly versatile set of propagation physics in a portion of the spectrum with an unusually low urban noise floor. Given these characteristics, the 1300-1390 MHz band has the potential to bridge mobile broadband capacity deficits in major markets.

developmental phases, including increasing the frequency range of existing WMTS devices (a process already being assessed by certain manufacturers), safety and efficacy testing, equipment certification, and system installation (*see* Figure 5). While the timelines for these respective phases would overlap, altogether these processes would likely take more than three years to complete industry-wide.⁵² Given this reality, TerreStar urges the Commission to grant a thirty-six month waiver of the Commission’s substantial service deadline for each of its EAG and MEA licenses, until April 23, 2020.

Figure 5: Timeline for Commercial Medical Telemetry Deployment - The available ecosystem for commercial medical telemetry at 1.4 GHz removes a significant obstacle to deployment of the new service. However, the life-critical nature of medical telemetry compels special care in the testing and certification of devices. Following a waiver grant, these processes and the installation of medical telemetry in TerreStar’s licensed spectrum at U.S. health care facilities would, industry-wide, likely take more than three years to complete.



In the first implementation phase, existing WMTS equipment and devices in the advanced production stage would be modified to permit operations on TerreStar’s spectrum at 1390-1395 MHz or 1432-1435 MHz. TerreStar and WMTS manufacturers would assess the universe of WMTS equipment models and, on a case-by-case basis, determine the optimal means of expanding the frequency range of these devices. TerreStar expects that, for most device

⁵² For some WMTS device models, each of these developmental phases could be completed expeditiously, resulting in deployment of those systems in major health care facilities by 2018 (*see supra* at 20).

models, WMTS manufacturers would identify an appropriate software or firmware update that enables this change. Once the precise procedure is identified, vendors would undertake the necessary testing for this conversion process, including evaluation of software/firmware definition protocols. After a manufacturer has verified the effectiveness of the conversion process for a particular device model, it would make that modification to the targeted population of devices. TerreStar expects that, industry-wide, this frequency conversion phase would last six to twelve months and would be largely completed by **August 2017**.⁵³

In a second developmental phase, TerreStar and WMTS manufacturers would initiate safety and efficacy testing for wireless medical telemetry devices operating in TerreStar's 1.4 GHz spectrum. Given the life-critical nature of wireless medical telemetry, TerreStar and WMTS interests must demonstrate special care in the development and testing of modified Part 95 equipment. This equipment cannot be put into use in hospitals and other health care environments until WMTS vendors confirm the high-quality performance of these medical systems. This implementation stage would involve the development of prototype devices and trial deployments in laboratories and other test facilities. TerreStar expects that this safety and quality testing phase would last approximately twelve to eighteen months and would be largely completed by **December 2017**.

On the regulatory side, TerreStar and WMTS manufacturers would have to complete the equipment certification process before modified WMTS equipment can operate in the field on TerreStar's licensed 1.4 GHz spectrum. Because modified WMTS equipment transmitting on TerreStar's frequencies would operate under a different rule part (Part 27 of the Commission's

⁵³ As indicated above, as a result of TerreStar's discussions with the WMTS industry, certain equipment manufacturers have already begun the process of determining the best means of expanding the active frequency range of their equipment.

rules as opposed to Part 95), it appears that this equipment modification would require re-certification rather than the Commission's streamlined permissive change process. Original grantees for these devices would have to prepare and submit certification filings that include all the exhibits typically required for a new approval, to demonstrate compliance with Part 27 rules and show that modified medical telemetry equipment transmitting on TerreStar's frequencies would not interfere with existing WMTS operations at 1395-1400 MHz and 1427-1432 MHz. This implementation phase would include laboratory compliance testing and waiting periods for Telecommunications Certification Body ("TCB") approval. Overall, TerreStar estimates that it would take twelve to eighteen months to complete equipment re-certification for the critical mass of WMTS devices required for a comprehensive, national WMTS roll-out in the commercial 1.4 GHz band.⁵⁴ TerreStar hopes that this re-certification process would be largely completed by **June 2018**.

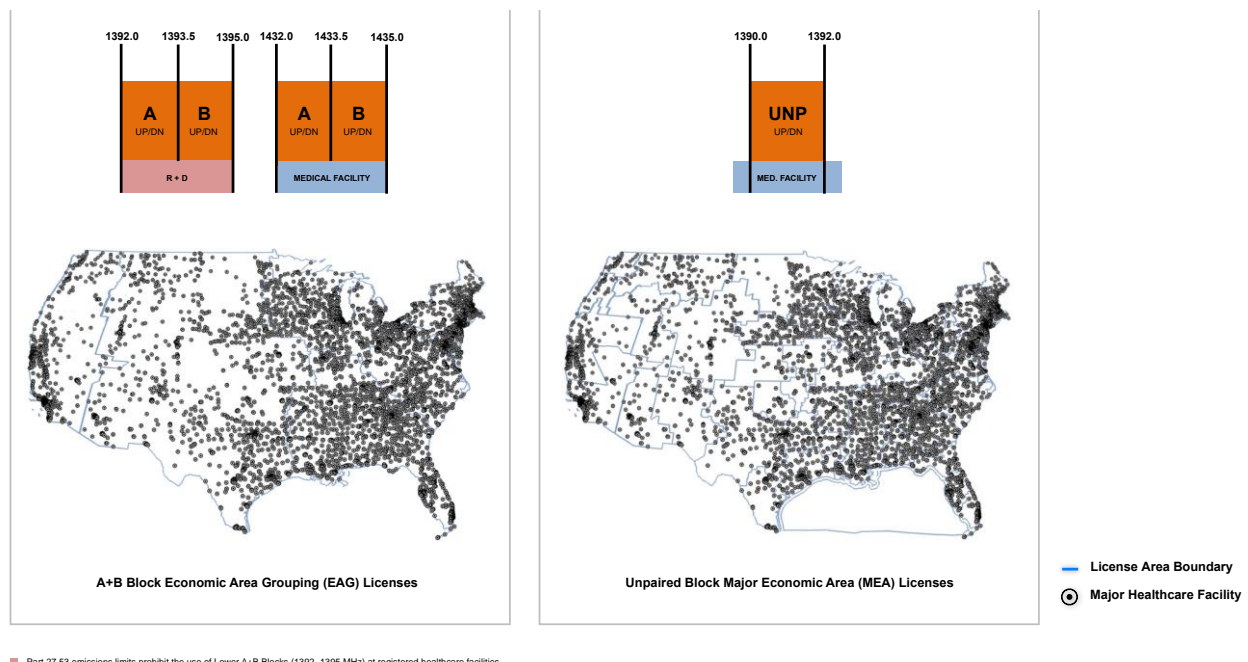
Once WMTS systems and devices have been certified to operate in TerreStar's spectrum and a wireless medical telemetry database is in place in the commercial 1.4 GHz band, health care providers and other spectrum manager lessees could begin deploying that equipment at registered health care facilities around the country. As indicated above, TerreStar expects that WMTS deployments would likely begin in large health care facilities with the most extensive wireless patient monitoring during 2018, and that by **January 2020** there would be operational deployments at a significant fraction of health care facilities with existing WMTS systems.

TerreStar anticipates that, by **April 2020**, there would be a robust, deployment of wireless

⁵⁴ If the Commission determined that the permissive change process is the appropriate mechanism for these equipment modifications, that decision would expedite this phase of the WMTS implementation process in TerreStar's spectrum. *See, e.g.*, 47 C.F.R. § 2.1043. Permissive change submissions are typically less extensive and are processed more quickly than re-certification filings. Such changes are generally approved after a TCB conducts an expeditious review of a device's revised performance characteristics.

medical telemetry equipment in each of TerreStar’s license areas, covering thousands of health care facilities throughout the United States. As shown in Figure 6 below, every EAG license area (TerreStar’s A and B Block licenses) and MEA license area (TerreStar’s unpaired licenses) in the United States contains a significant number of these major health care facilities. If the Commission grants the instant waiver request, TerreStar anticipates that the deployment of WMTS equipment at a substantial percentage of these major health care facilities (likely including numerous health care facilities in each EAG and MEA license area) – in combination with WMTS use in mobile environments, residential locations, research and development facilities, and other innovative settings – would satisfy the substantial service requirement for each of its commercial 1.4 GHz licenses by the new April 23, 2020 deadline.

Figure 6: Geographic Distribution of Addressable Healthcare Facilities - Rollout of a commercial medical telemetry service in TerreStar’s commercial 1.4 GHz spectrum would likely rival the geographic reach of current and planned 1.4 GHz WMTS applications. These deployments would likely encompass several thousand health care facilities spread across every major population center in the United States. TerreStar anticipates that there would be significant public interest benefits in each EAG and MEA license area.



IV. Conclusion

For the aforementioned reasons described in this request, TerreStar satisfies the Commission's requirements for a waiver of its substantial service rules. TerreStar requests that the Commission temporarily waive the substantial service requirement for its licensed 1.4 GHz spectrum, including its A and B Block EAG licenses and its unpaired MEA licenses, for thirty-six months, until April 23, 2020.

Respectfully submitted,

/s/ Regina M. Keeney

Regina M. Keeney

Stephen J. Berman

Lawler, Metzger, Keeney & Logan, LLC

1717 K Street NW, Suite 1075

Washington, DC 20006

(202) 777-7700

Counsel for TerreStar Corporation

August 12, 2016

EXHIBIT A

Philips Healthcare

July 21, 2016

Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: TerreStar Corporation Request for Temporary Waiver of Substantial
Service Requirements

Dear Ms. Dortch:

Philips Healthcare (Philips) understands that the TerreStar Corporation (TerreStar) is submitting to the Commission a request for temporary waiver of the substantial service rule for its licensed commercial 1.4 GHz spectrum. Philips is the world leader in patient monitoring equipment and the largest provider of 1.4 GHz WMTS equipment to healthcare facilities in the United States. Philips has discussed with TerreStar the possibility of utilizing its adjoining licensed 1.4 GHz spectrum on a long-term basis for WMTS service and urges the Commission to grant the requested waiver. Grant of the waiver will facilitate generating critical benefits for health care providers and patients throughout the country by enabling WMTS use of TerreStar's spectrum.

Hospitals and medical providers increasingly rely on twenty-first century information and communications technologies. WMTS represents an important tool to provide better health care. Wireless monitoring enables health care providers to respond more rapidly to changes in patients' condition and thereby noticeably improve the quality of patients' experience and outcomes. Demand for WMTS remote patient monitoring is increasing. More spectrum is needed to provide the needed service and capabilities. This issue has become more urgent as interference threats to medical telemetry have emerged both in the dedicated WMTS spectrum in the 600 MHz band and the unlicensed ISM band has become more crowded.¹

The Commission's grant of TerreStar's request for a temporary waiver will address the need for additional WMTS spectrum in a realistic and timely fashion. Pursuant to discussions with TerreStar, we are confident that, following grant of the waiver request,

¹ Philips addressed the need for additional spectrum in WP Docket 07-100. *See*, for example, Philips Healthcare's Comments in response to the Second Further Notice in that proceeding, dated May 14, 2010. The need expressed therein is even more critical now.



WMTS at 1.4 GHz will have the opportunity to utilize TerreStar's spectrum at 1390-1395 MHz and 1432-1435 MHz. The waiver and TerreStar's work would significantly increase the supply of 1.4 GHz medical telemetry spectrum and allow a substantial expansion of WMTS capacity that today is foreclosed by spectrum restraints. Grant of TerreStar's request also would permit research and development of innovative medical telemetry applications outside of health care facilities.

We note with approval that TerreStar's planned framework for WMTS in the 1.4 GHz band includes a registration and frequency coordination database similar to the existing WMTS database. This will make this expansion of WMTS capacity as seamless as possible for hospitals and other healthcare providers.

Philips appreciates TerreStar's interest in protecting WMTS from interference and enhancing wireless medical telemetry capabilities in response to growing health care needs. We also agree with TerreStar that the development of WMTS in its licensed spectrum likely will take three years, as TerreStar, equipment manufacturers, and health care providers work through a number of complex processes that must be completed to realize this deployment. We also appreciate the long term thinking from TerreStar to jointly develop the spectrum regulatory processes to help optimize long term utilization for both TerreStar and WMTS customers. Accordingly, we urge the Commission to grant TerreStar's request for a three-year temporary waiver of its substantial service requirement.

Respectfully submitted,



Delroy Smith
Principal Scientist, R&D Project Leader
PHILIPS HEALTHCARE
3000 Minuteman Road MS 450
Andover, MA 01810





GE Healthcare Technologies

Matt Pekarske
Principal Engineer - Wireless

8200 W. Tower Ave
Milwaukee, WI 53223
USA

T 414-362-2715
F 414-362-2880
Matthew.Pekarske@ge.com

TO: Federal Communication Commission
Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Date: 22-JUL-2016

Regarding: TerreStar Corporation Request for Temporary Waiver of Substantial Service Requirements

Dear Ms. Dortch:

Concurrent with this letter, TerreStar Corporation ("TerreStar") is submitting a request for temporary waiver of the substantial service deadline for its licensed commercial 1.4 GHz spectrum. GE Healthcare ("GEHC"), which has a strong interest in improved wireless medical telemetry service ("WMTS") around the United States, urges the Federal Communications Commission ("Commission") to grant the requested waiver. This action will enable WMTS use of TerreStar's spectrum and generate critical near-term benefits for health care providers and millions of patients throughout the country.

The Commission has long recognized the importance of WMTS to patient care and the critical need to protect its "safety-of-life" operations from harmful interference.¹ Wireless medical telemetry equipment is routinely used in hospitals and other healthcare facilities to monitor in real time patient data (such as electrocardiography, heart rate, and oxygen saturation data), which is used to detect life-threatening events (e.g., cardiac arrhythmias and apneas).² As the Commission is aware, the American Society for Health Care Engineering of the American Hospital Association ("ASHE"), which is the FCC-designated frequency coordinator for WMTS systems, estimates that WMTS systems are deployed in over 2,700 unique locations.³ Moreover, this number is expected to increase significantly in the future as hospitals experience higher patient acuities and an aging patient population with multiple medical problems.⁴ Thus, as a widely used critical safety-of-life service, additional spectrum for WMTS spectrum is needed to meet the growing demand for remote patient monitoring.

¹ See, e.g., *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd 6567 (2014) ("*Incentive Auction R&O*").

² See, e.g., Comments of GE Healthcare, GN Docket No. 12-268, at 1 (Jan. 25, 2013) ("*GEHC Comments*").

³ *In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 27 FCC Rcd 12357 ¶ 210 (2012).

⁴ See, e.g., Research and Markets, *Cardiac Monitoring And Diagnostic Devices - Global Trends, Estimates and Forecasts, 2012-2018* (June 2014) ("The Cardiac Monitoring and Diagnostic Devices market is expected to reach US\$2.3 billion by 2017."), available at <http://www.researchandmarkets.com/reports/2882672/cardiac-monitoring-and-diagnosticdevices>.

By empowering healthcare providers to remotely monitor their patients' physiological data, WMTS equipment has played a transformative role in the healthcare industry, "provid[ing] significant benefits to patients in terms of mobility and comfort" and emerging as a "significant tool in reducing healthcare costs," as the Commission has recognized.⁵ Since 2000, when the Commission first allocated Channel 37 to WMTS, the healthcare industry has invested billions of dollars developing and deploying WMTS systems, with GEHC playing a leading role in those efforts.

The Commission can address this need for additional WMTS spectrum by granting TerreStar's request for temporary waiver. Following a waiver grant, the existing WMTS infrastructure at 1.4 GHz would have the opportunity to utilize TerreStar's spectrum at 1390-1392 MHz and 1432-1435 MHz, and some new mobile WMTS applications could be deployed at 1392-1395 MHz. Within health care facilities, this waiver would increase the supply of medical telemetry spectrum at 1.4 GHz by approximately 67%, a substantial expansion of WMTS capacity. For the 1392-1395MHz spectrum, this waiver would permit research and development and innovative medical telemetry applications outside of health care facilities through April 1, 2020 and beyond that date on a non-interfering basis. For the 1432-1435MHz spectrum, it could be permanently converted to Part 95 rules to expand WMTS operations to that band and promote broader development in the WMTS community. In addition, TerreStar's planned framework for WMTS in the 1.4 GHz band – including a registration and frequency coordination database similar to the existing WMTS database – should make this expansion of WMTS capacity as seamless as possible for hospitals and other health care providers.

Over the past year, GEHC has engaged in numerous discussions with TerreStar's representatives. We appreciate TerreStar's interest in protecting WMTS from interference and enhancing wireless medical telemetry capabilities in response to growing health care needs. We also agree with TerreStar that the development of WMTS in its licensed spectrum will take at least three years, as TerreStar, equipment manufacturers, and health care providers work through a number of complex processes that must be completed to realize this deployment. Upon agreement of required rule changes and operational procedures for WMTS deploying in the 1390-1392, 1392-1395, and 1432-1435MHz bands, Terrestar and WMTS manufacturers will file a joint proposal with the FCC to help guide future rule-making proceedings. Accordingly, and as a first step in meeting the growing demands for WMTS, we urge the Commission to grant TerreStar's request for a temporary waiver of its substantial service requirement, until April 1, 2020.

Respectfully submitted,
Matt Pekarske

Name (Printed): *Matthew R Pekarske* Title: *Principal Engineer - Wireless*

Signature: *Matthew R Pekarske* *22-JUL-2016*

⁵ Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service, Order, 16 FCC Rcd 4543 ¶ 2 (2001); see also WMTS R&O ¶ 1; In the Matter of Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, First Report and Order and Further Notice of Proposed Rulemaking, 27 FCC Rcd 6422 ¶ 8 (2012); 47 C.F.R. § 95 subpart H.

EXHIBIT B

Medical Telemetry Use of Commercial 1.4 GHz

Substantial Service Waiver to Enable a Commercial Medical Telemetry Service

August 2016

Introduction

Wireless medical telemetry provides a number of important services that are of significant national interest. Critical to life and safety by definition, the wireless delivery of real-time biometrics has meaningfully increased the standard of patient care over the past two decades.

Today, however, the gains in safety and quality of care enabled by wireless medical telemetry are under threat as the underlying radio-frequency spectrum resources that support such services erode. At 2.4 GHz, the explosion of unlicensed Wi-Fi related interference has prompted regulators to compel migration from the band. At 600 MHz, the introduction of both co-channel unlicensed services and adjacent channel high power commercial services has put future efficacy of the band into serious question. And at 1.4 GHz, the most secure Wireless Medical Telemetry Service (WMTS) allocation, limited frequency resources means that many health care facilities are already reaching maximum capacity.

TerreStar is the nationwide license holder for commercial bands immediately adjacent to both 1.4 GHz WMTS allocations (1395-1400 MHz and the 1427-1432 MHz "flip" band). Responding to serious concerns raised by WMTS interests over its intended 802.16 WiMAX Smart Grid deployment, TerreStar has for now abandoned its original buildout plans and instead is working to create a commercial medical telemetry service that is compatible with a bulk of existing Part 95 equipment. This service will remove the threat of adjacent channel interference and expand medical telemetry capacity by 67% in the otherwise saturated 1.4 GHz WMTS band.

The purpose of the attached presentation is to review:

- **Significant Capacity Challenges Facing Wireless Medical Telemetry Spectrum**
- **WMTS interference Concerns Associated with TerreStar's Planned 802.16 Smart Grid Application**
- **A New Commercial Wireless Medical Telemetry Service Using TerreStar 1.4 GHz Allocations**
- **Substantial Service Waiver Requirements for a New Commercial 1.4 GHz Wireless Medical Telemetry Service**

Contents

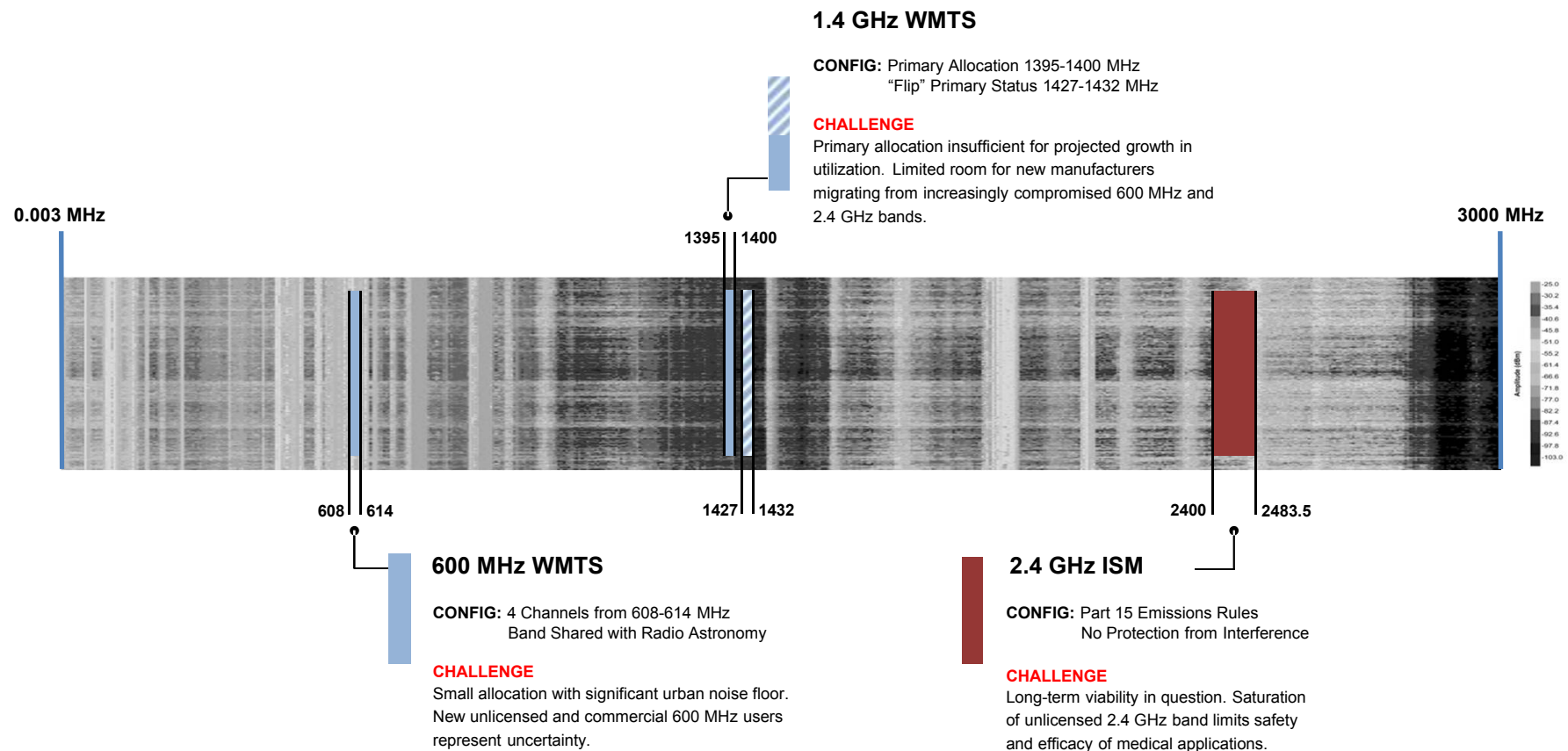
- **Introduction**..... 2
- **Section I:** Understanding Medical Telemetry Challenges..... 4
- **Section II:** WMTS Interference Concerns Regarding Commercial 1.4 GHz..... 11
- **Section III:** Creating a Commercial Medical Telemetry Service at 1.4 GHz..... 17
- **Section IV:** Substantial Service Waiver for Commercial Medical Telemetry..... 24

Section I

Understanding Medical Telemetry Challenges

Medical Telemetry Band Summary

Though medical telemetry applications have access to three spectrum allocations, only the 1.4 GHz WMTS band represents an authorization suitable for high-priority patient monitoring capabilities. The 7.5 MHz of primary nationwide allocation (1395-1400 MHz, 1427-1429.5 or 1429-1431.5 MHz) is increasingly viewed as critical for applications not suited to coexistence with unlicensed services.



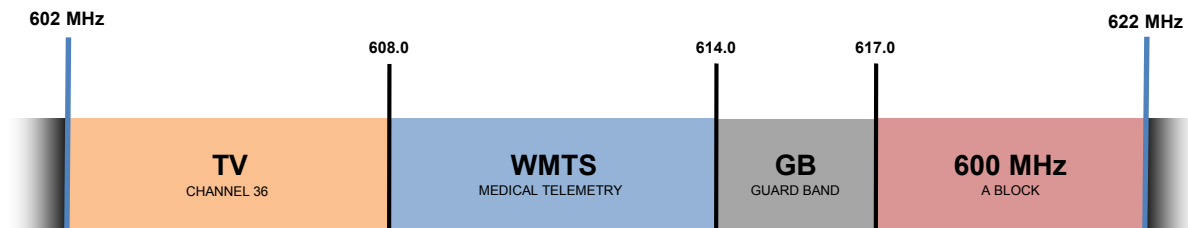
600 MHz Band

Significant WMTS applications have evolved on the 6 MHz of unused TV Channel 37. Shared with Radio Astronomy (RAS) and protected nationwide, 600 MHz has been a safe haven for medical telemetry. Today, introduction of commercial networks in adjacent spectrum and opening of unlicensed services in Channel 37 represent a significant interference threat.

Clearing Scenarios Below 76 MHz



84 MHz Clearing Scenario

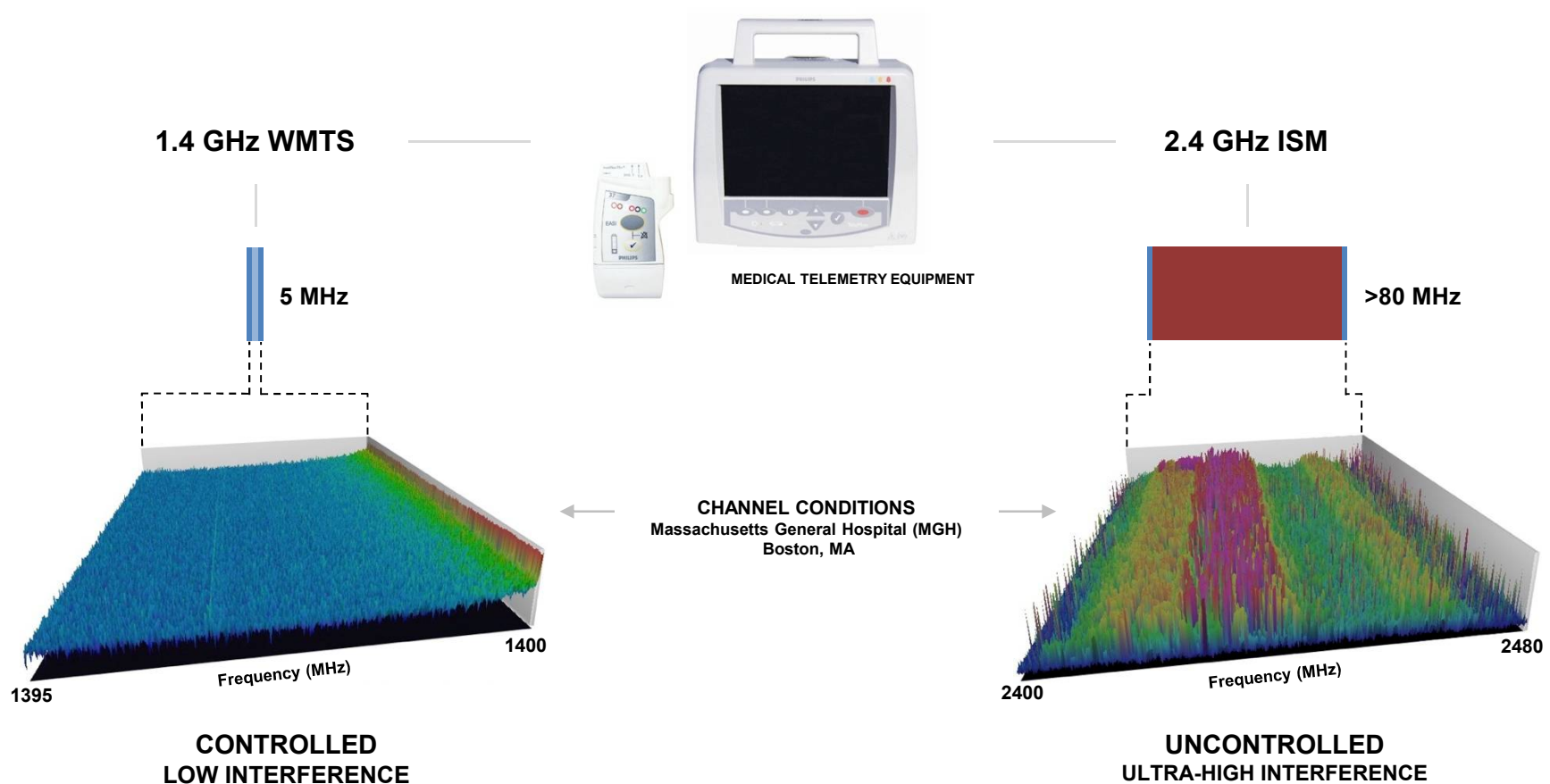


108 MHz - 144 MHz Clearing Scenarios



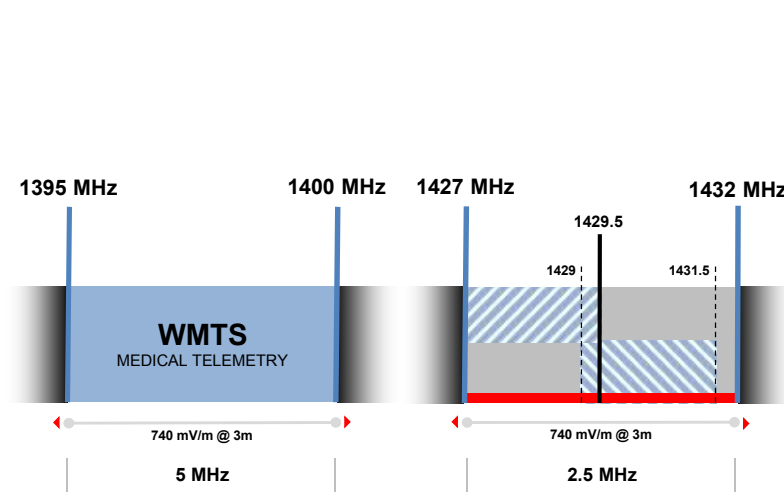
2.4 GHz Band

In the United States, many medical telemetry systems come with the option of either 1.4 GHz WMTS or 2.4 GHz ISM Band transceivers. While 2.4 GHz ISM offers many times the available bandwidth and an extremely low cost component ecosystem, the ultra-high interference levels seen in Part 15 spectrum compel a need for protected primary WMTS allocations.



1.4 GHz Band

In the 1.4 GHz band, medical telemetry applications are limited to just 5 MHz of nationwide primary allocation from 1395 - 1400 MHz. While an additional 2.5 MHz of “flip” spectrum is available for WMTS in the 1.4 GHz band, it is shared with high-power utility applications and has a complex geographically determined primary status.



*Shared Spectrum

Nationwide
Primary WMTS

Outside of “Flip”
Primary WMTS

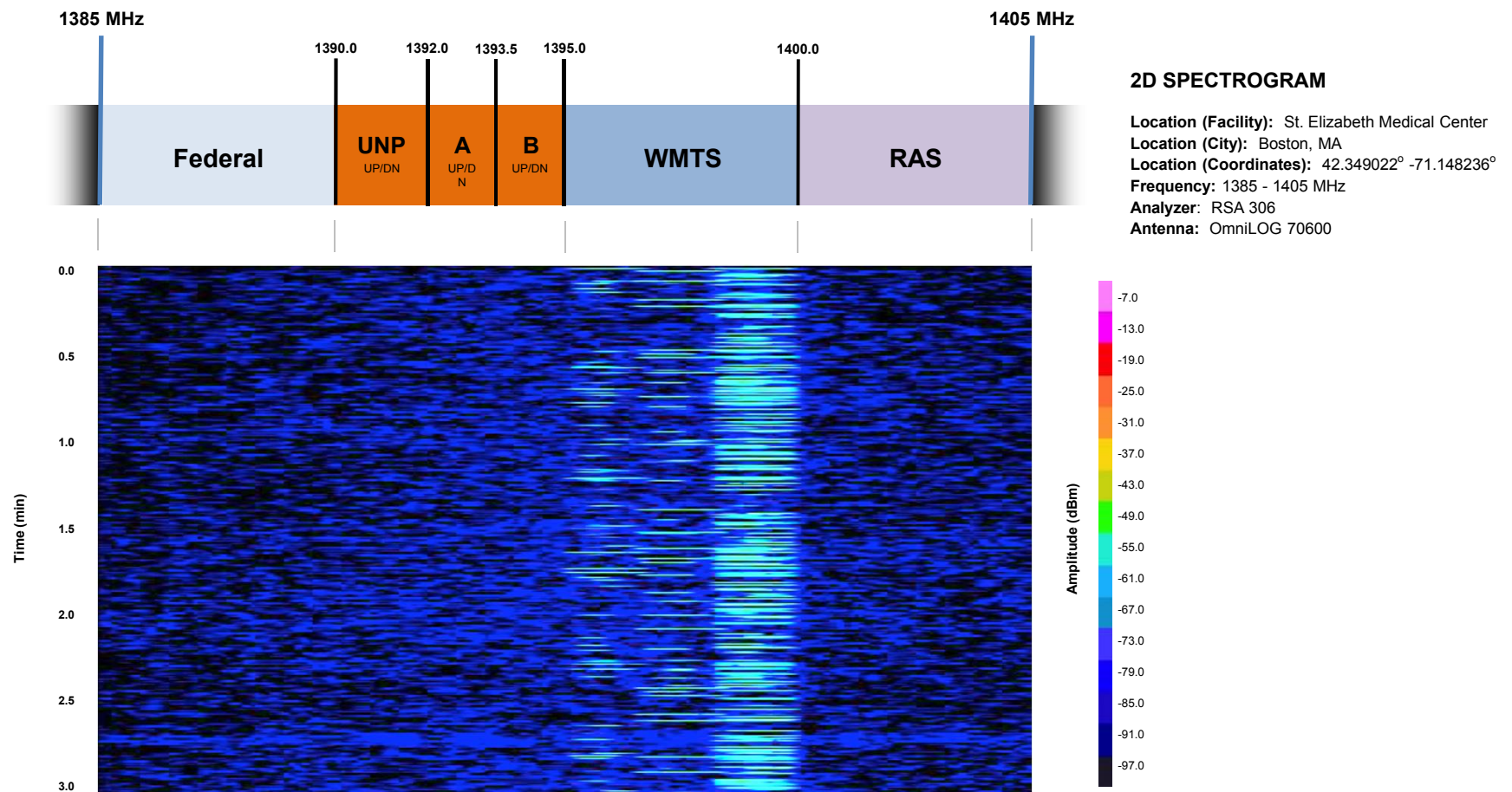
Inside of “Flip”
Primary WMTS

***1427-1432 MHz:** The channels in this spectrum band are shared by WMTS devices and non-WMTS devices such as utility telemetry devices. Generally, WMTS devices have primary status in the 1427-1429.5 MHz segment and non-WMTS devices have primary status in the 1429.5-1432 MHz segment, but there are seven geographical areas where WMTS and non-WMTS status is “flipped” and WMTS devices have primary status in the 1429-1431.5 MHz segment and non-WMTS devices have primary status in the other segments of the band:

1. Pittsburgh, PA
2. Washington, D.C.
3. Richmond/Norfolk, VA
4. Austin/Georgetown, TX
5. Battle Creek, MI
6. Detroit, MI
7. Spokane, WA

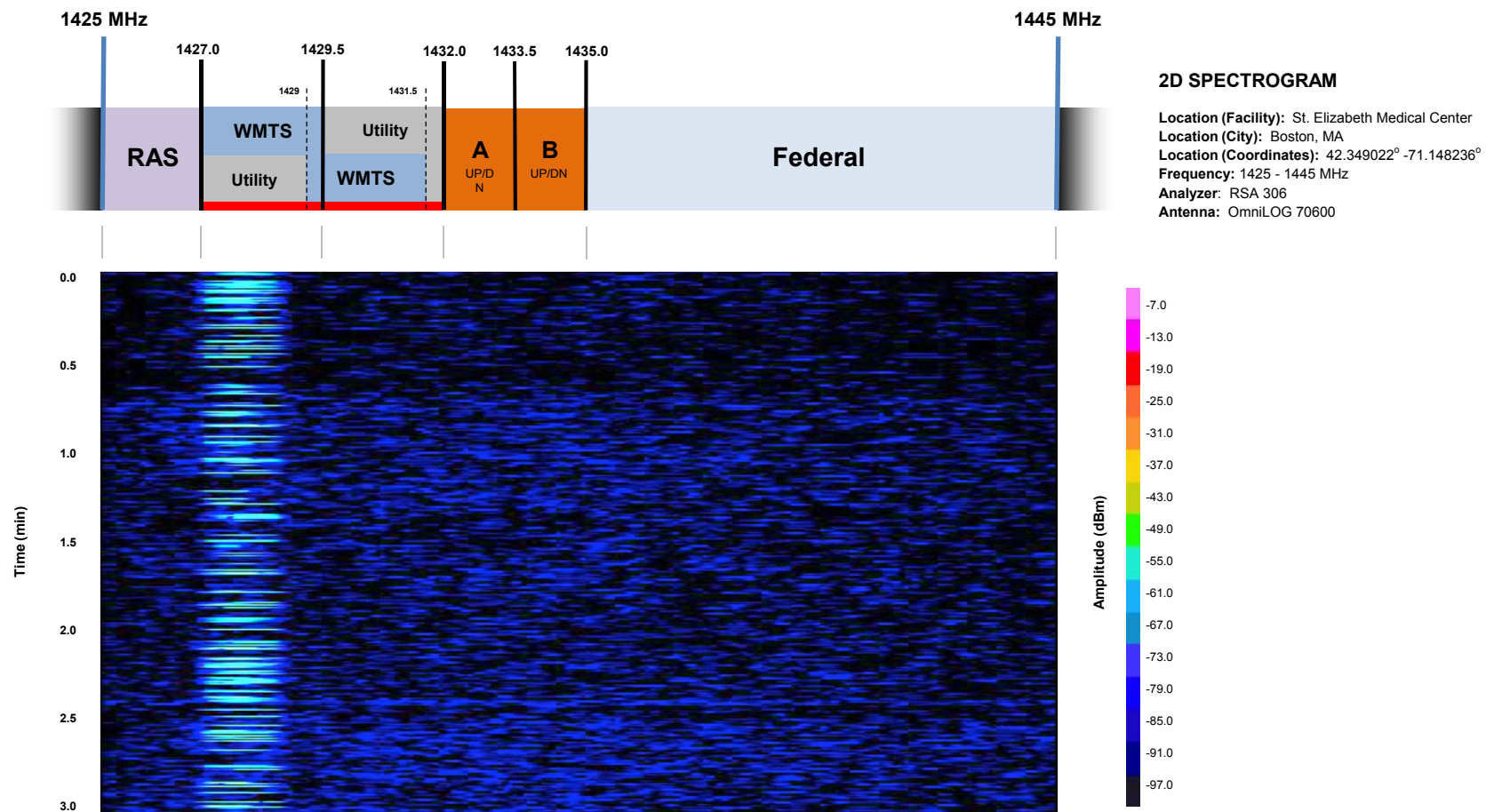
Spectrographic Overview of Lower 1.4 GHz Medical Telemetry

The spectrogram below depicts lower WMTS band activity in a typical Boston area hospital. Even low density medical facilities are near saturation on 1.4 GHz in their cardiac and pulmonary wards. As is the case in the upper 1.4 GHz band, increasing system density or the addition of competing manufacturers may be impossible with the existing resource.



Spectrographic Overview of Upper 1.4 GHz Medical Telemetry

The spectrogram below depicts upper “flip band” WMTS activity in a typical Boston area hospital. As may be seen in the lower band study, traffic levels are nearing saturation even in facilities where both bands are occupied by systems from a single manufacturer. Migration from other medical telemetry allocations (*e.g.*, 600 MHz or 2.4 GHz) will be challenging in such an environment.

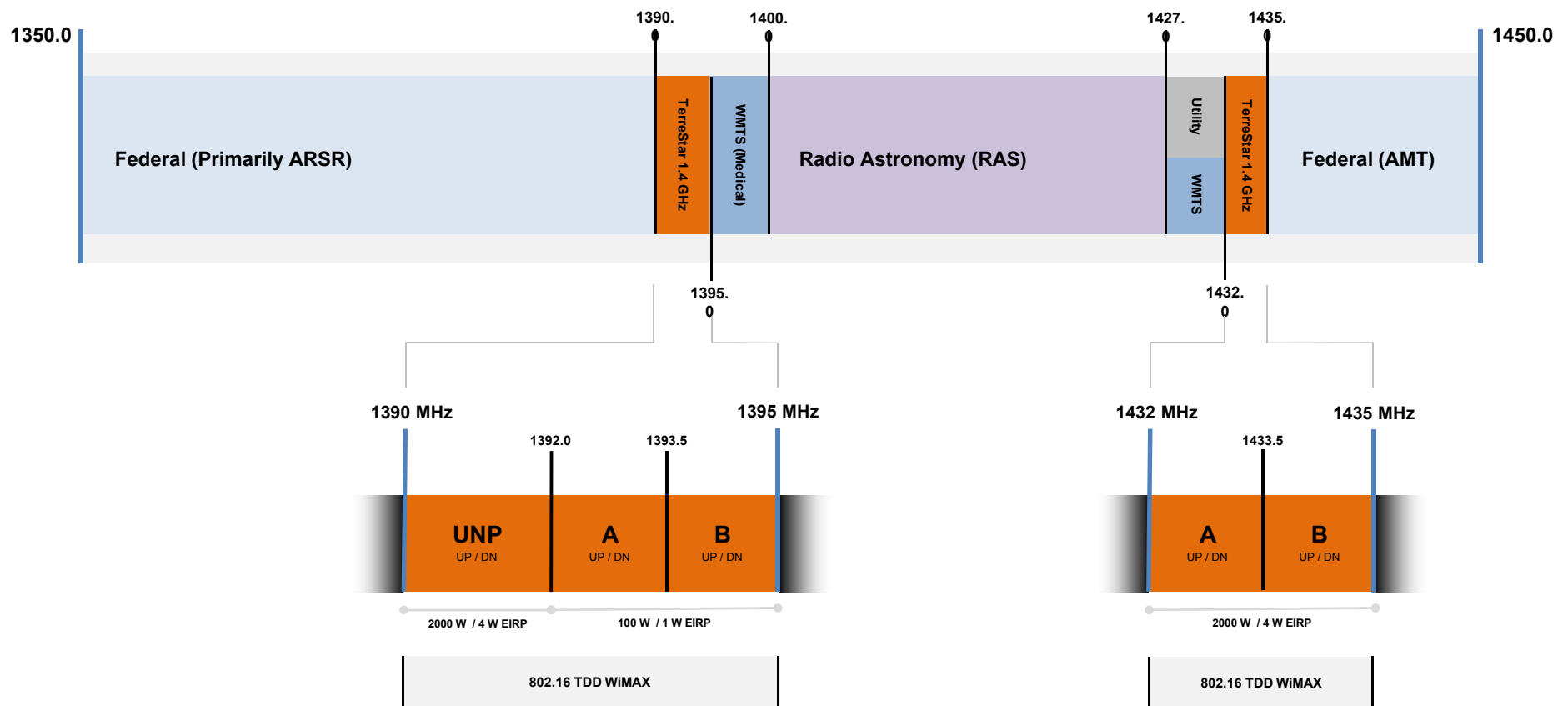


Section II

WMTS Interference Concerns Regarding Commercial 1.4 GHz

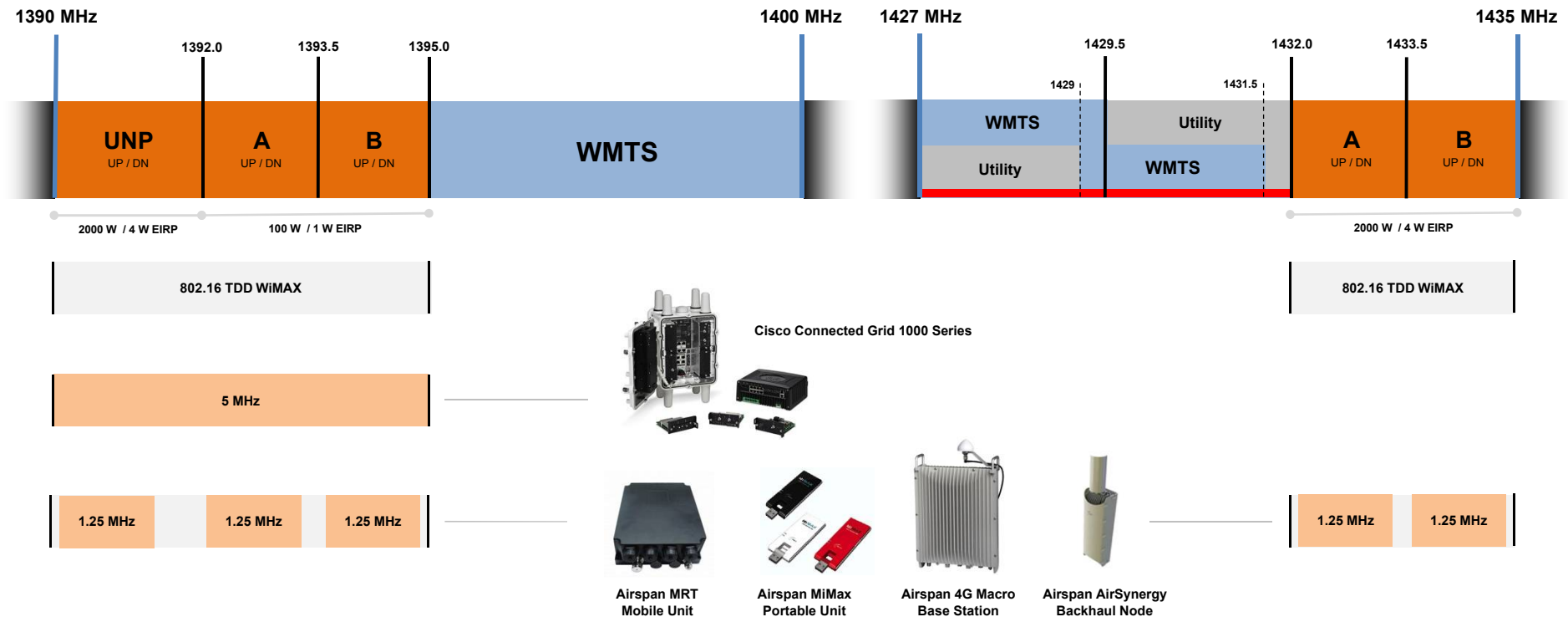
Planned Commercial 1.4 GHz TDD WiMAX

A comprehensive 802.16 WiMAX solution has been developed for the commercial 1.4 GHz band, which targets general utility customers across the United States. Test versions of these systems have been deployed across EAGs leased to carriers and utilities in recent years, representing a response to growing commercial demands for Smart Grid solutions built upon dedicated and licensed spectrum.



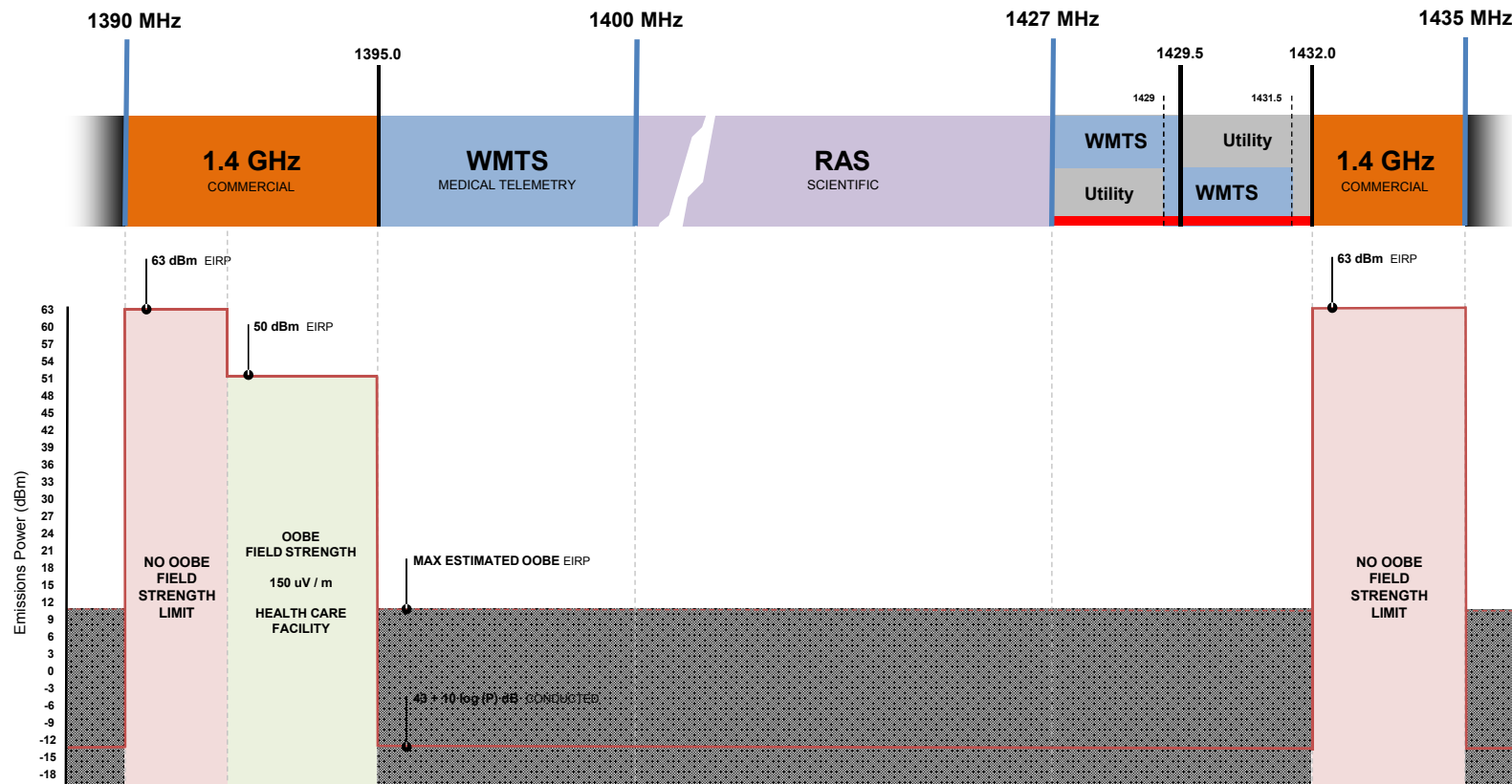
1.4 GHz TDD WiMAX Device and Infrastructure Ecosystem

Significant resources have been deployed to develop and certify a robust Smart Grid ecosystem using commercial 1.4 GHz spectrum. The WiMAX standard is enabled through both Part 27 rules governing commercial 1.4 GHz that permit the high OOB associated with 802.16 waveforms and TDD operation across upper and lower band segments.



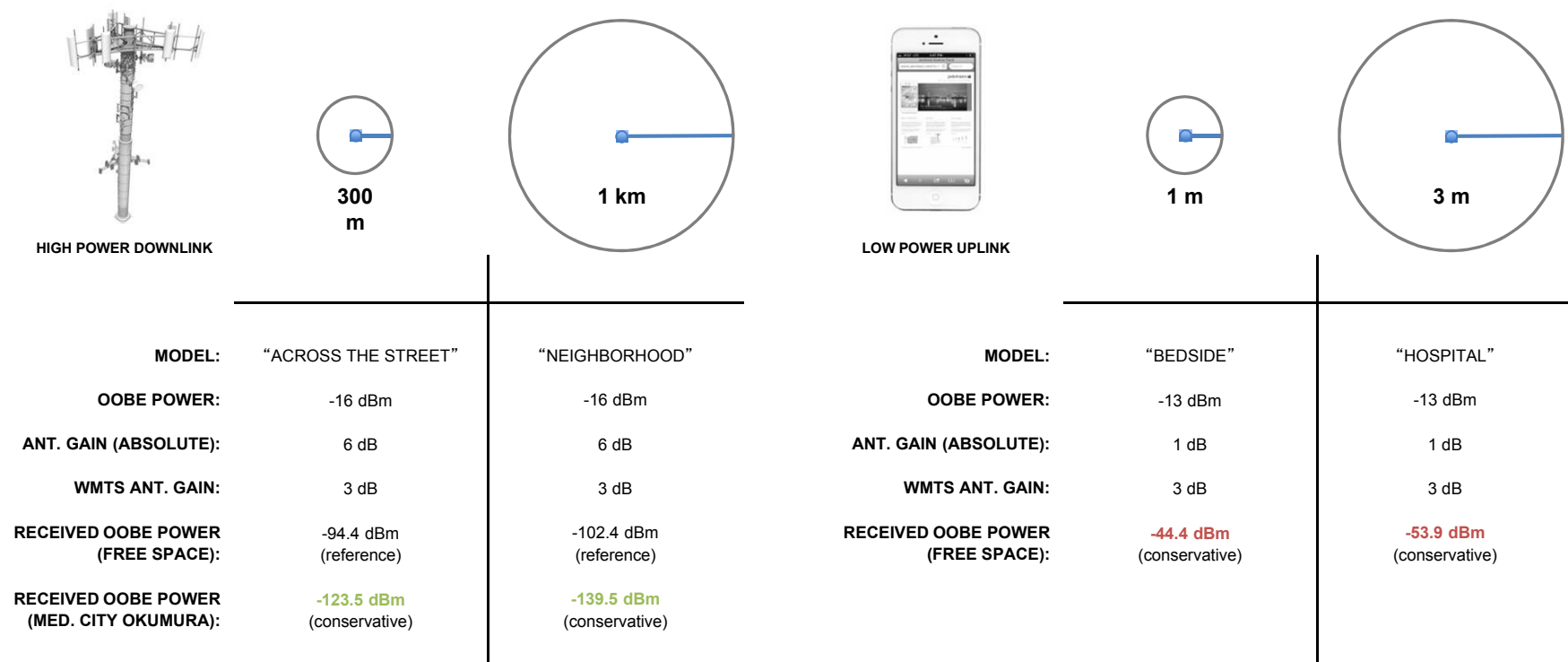
WMTS Concerns Over Out of Band Emissions

While the intended 802.16 TDD WiMAX application is fully compatible with existing Part 27 emissions limits, WMTS interests were alarmed by the potential for out of band emissions that may severely compromise the safety and efficacy of medical telemetry operations. This is especially true for mobile applications, to which WMTS facilities are considered especially vulnerable.



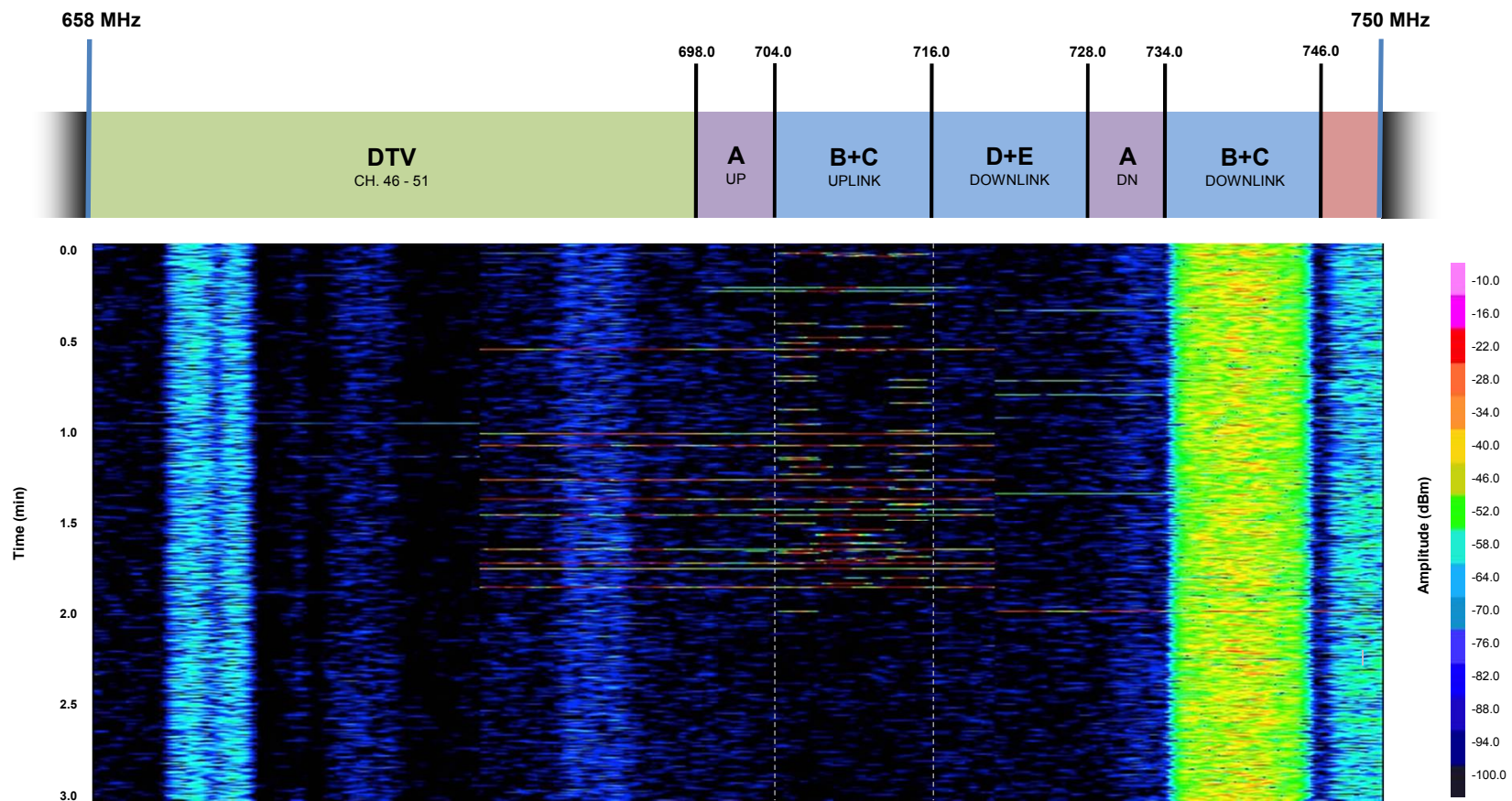
Specific Interference Threats Associated with Uplink

While base stations typically emit much higher fundamental emissions power than mobile devices, spatial separation and the ability to strongly attenuate Out of Band Emissions (OOBE) often makes base station operation a far less impactful adjacent band neighbor. For this reason, WMTS stakeholders have advocated strongly for “downlink only” authority in adjacent commercial allocations.



Typical Spectra of Uplink Analog (700 MHz Lower B+C)

Using cleaner 700 MHz LTE waveforms as a conservative analog for 802.16 WiMAX, the emissions of typical mobile devices are observed generating significant adjacent band interference products. This is especially true over short ranges and in applications requiring high channel occupancy. Below, an iPhone 6S is measured from a 1 meter distance (bedside model) while conducting a Facetime call.

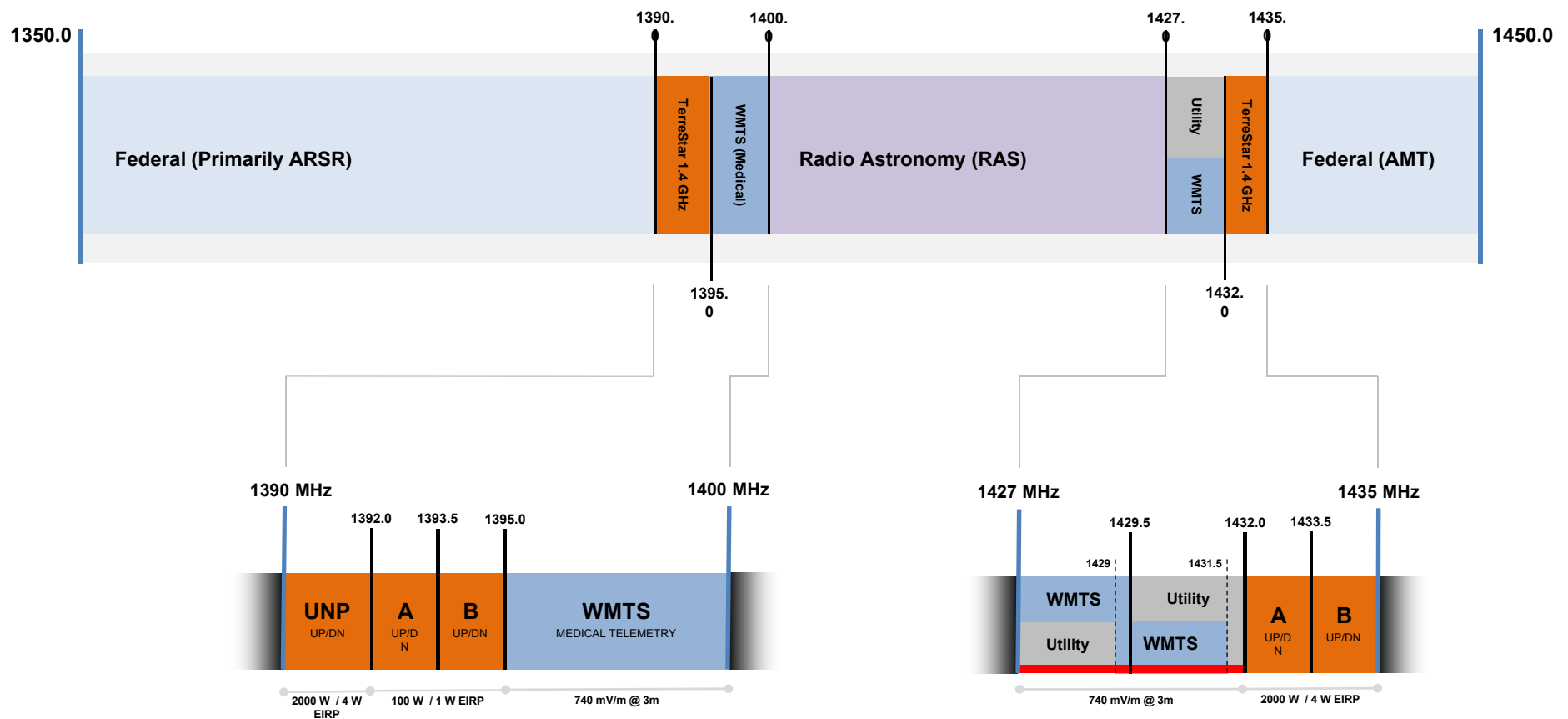


Section III

Creating a Commercial Medical Telemetry Service at 1.4 GHz

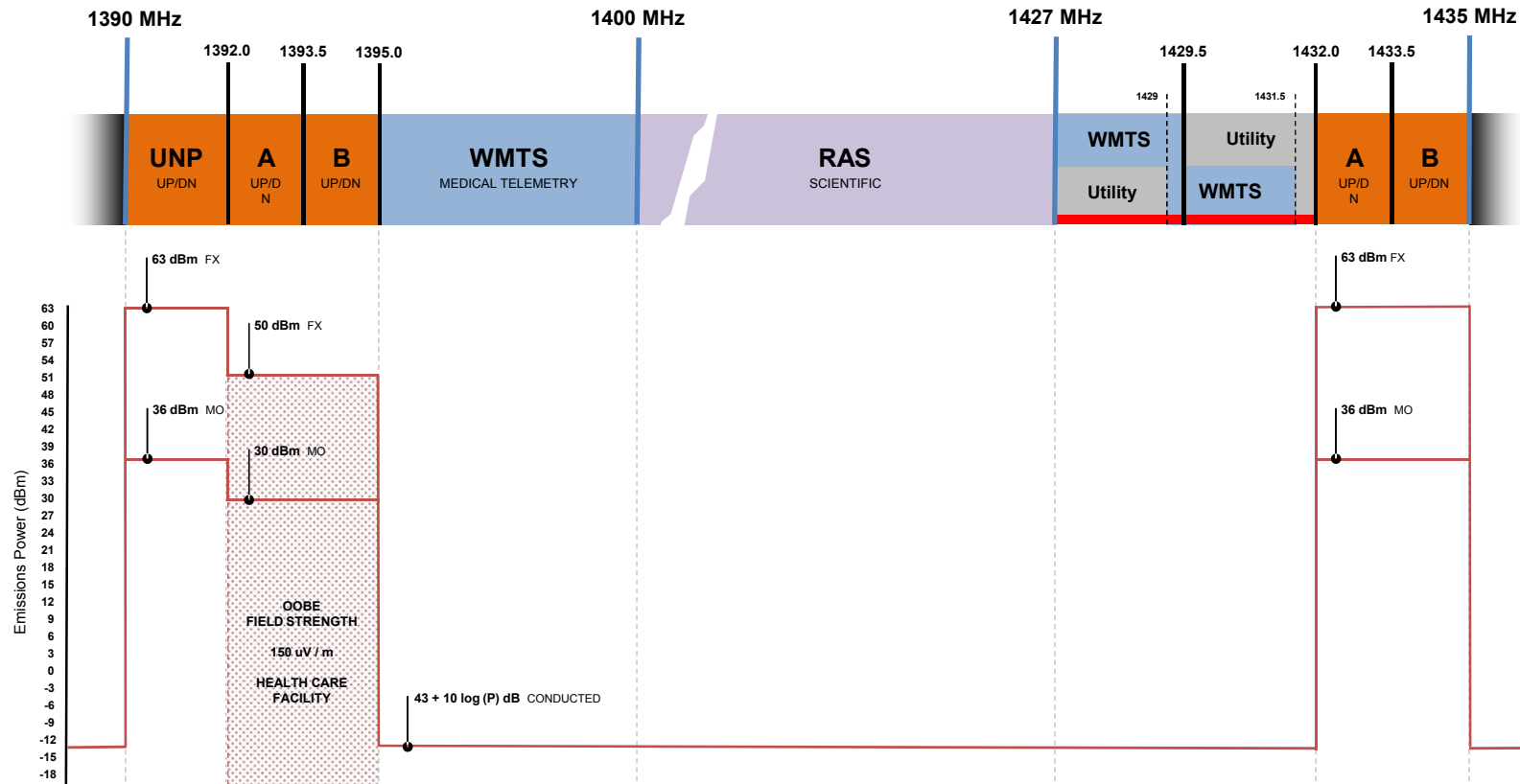
1.4 GHz Commercial and WMTS Bands

The two commercial 1.4 GHz bands held by TerreStar and two primary WMTS 1.4 GHz bands available to the medical device community sit directly adjacent to one another. While the unusual configuration and proximity of commercial band segments presents a high risk of interference from 802.16 applications, it also opens the potential to use the band for expansion of medical telemetry.



Detailed 1.4 GHz Emissions Limits

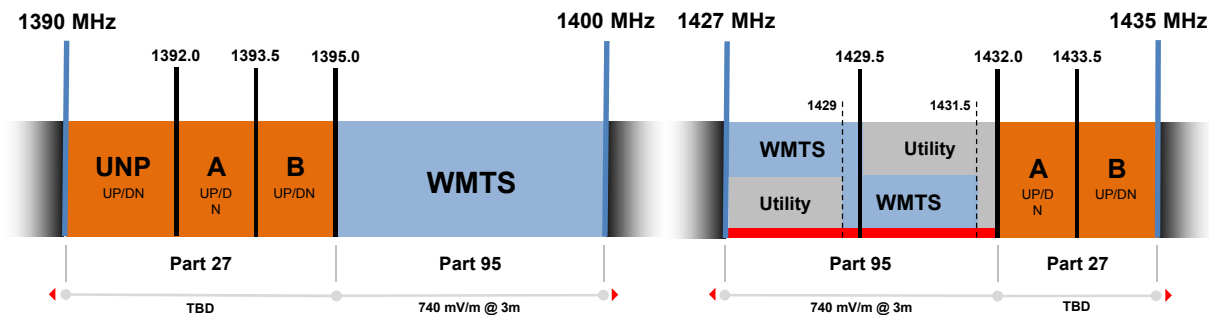
The TerreStar 1.4 GHz band is split into upper and lower segments with emissions rules that easily accommodate existing Part 95 WMTS devices and applications. Band segments are authorized for 100-2000 W EIRP base and 1-4 W EIRP mobile power and may be used for either uplink or downlink, with a minimal $43 + 10 \log (P)$ dB OOBE limit applied to all configurations.



Compatibility of Existing WMTS Hardware

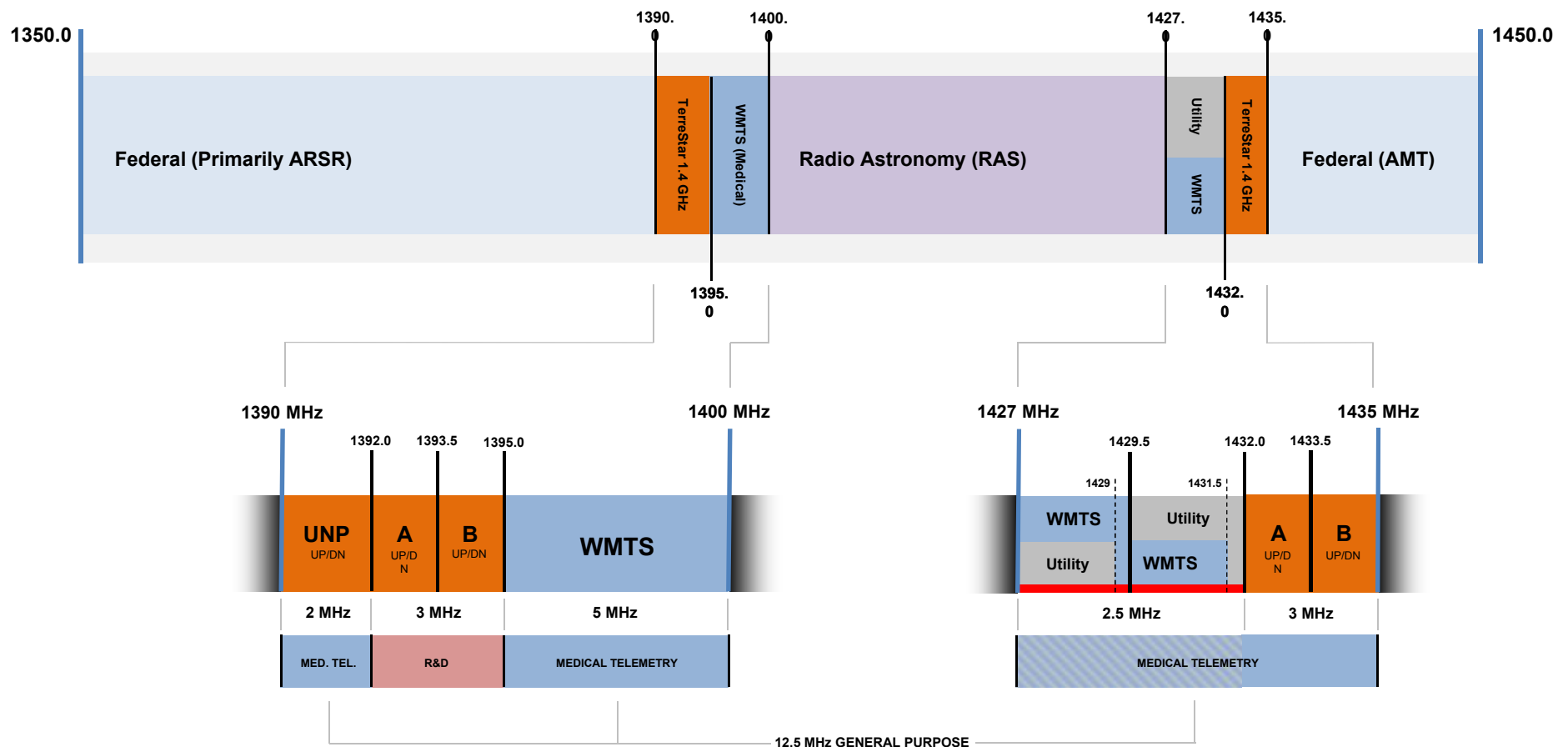
The immediate adjacency of commercial 1.4 GHz to WMTS permits many existing medical telemetry products to utilize the band via software definition and with little or no hardware modification. While this reality underscores adjacent band interference concerns, it also opens the compelling possibility for effectively immediate use of the band by existing Part 95 WMTS operators.

Existing Philips 1.4 GHz Intellivue Product Line



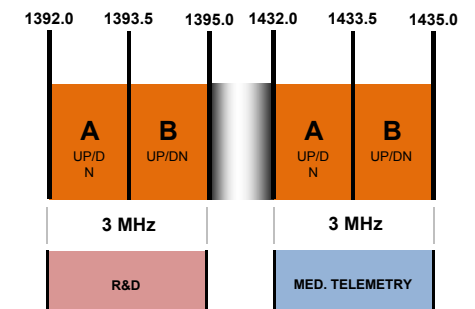
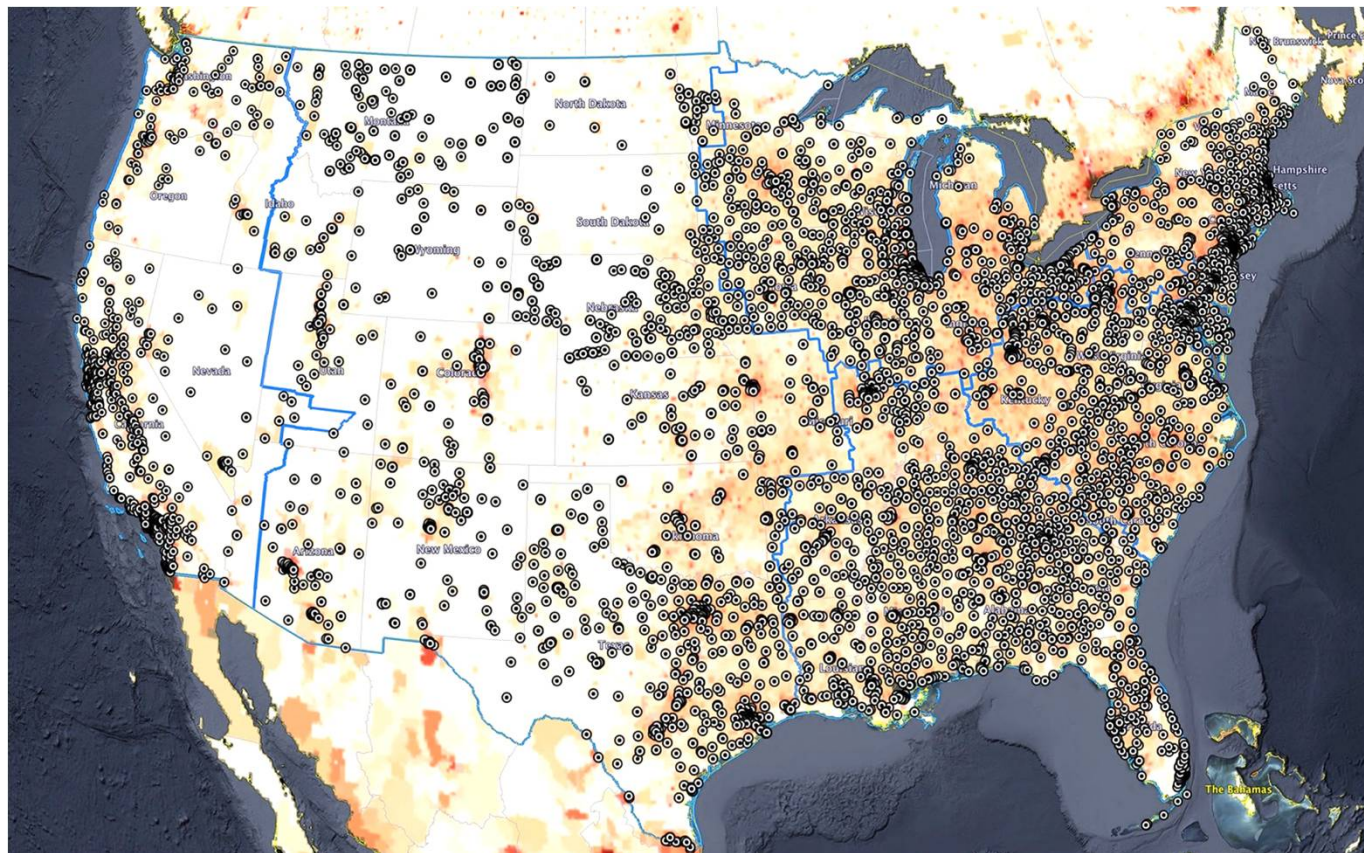
Effective Expansion of 1.4 GHz Medical Telemetry

Using the current and anticipated Part 95 WMTS ecosystem, a commercial medical telemetry service will expand available 1.4 GHz capacity from 7.5 MHz to 12.5 MHz (67% increase) nationwide. Also, an additional 3 MHz of the health care facility restricted Lower A+B Blocks (see Part 27.53) will be made available for medical telemetry on a research and development basis.



Major Health Care Facility Density Across 1.4 GHz EAGs

Several thousand major health care facilities exist across the 6 EAG license areas applied to the 1.4 GHz A+B Blocks. TerreStar plans to utilize the upper A+B Blocks at a majority of these facilities and other smaller health care centers in a manner similar to existing 1.4 GHz WMTS. Health care providers and device OEMs will be granted use of the Lower A+B Blocks for WMTS on an R&D basis outside of health care facilities.



Population Density Map

1.4 GHz A+B Block License Areas

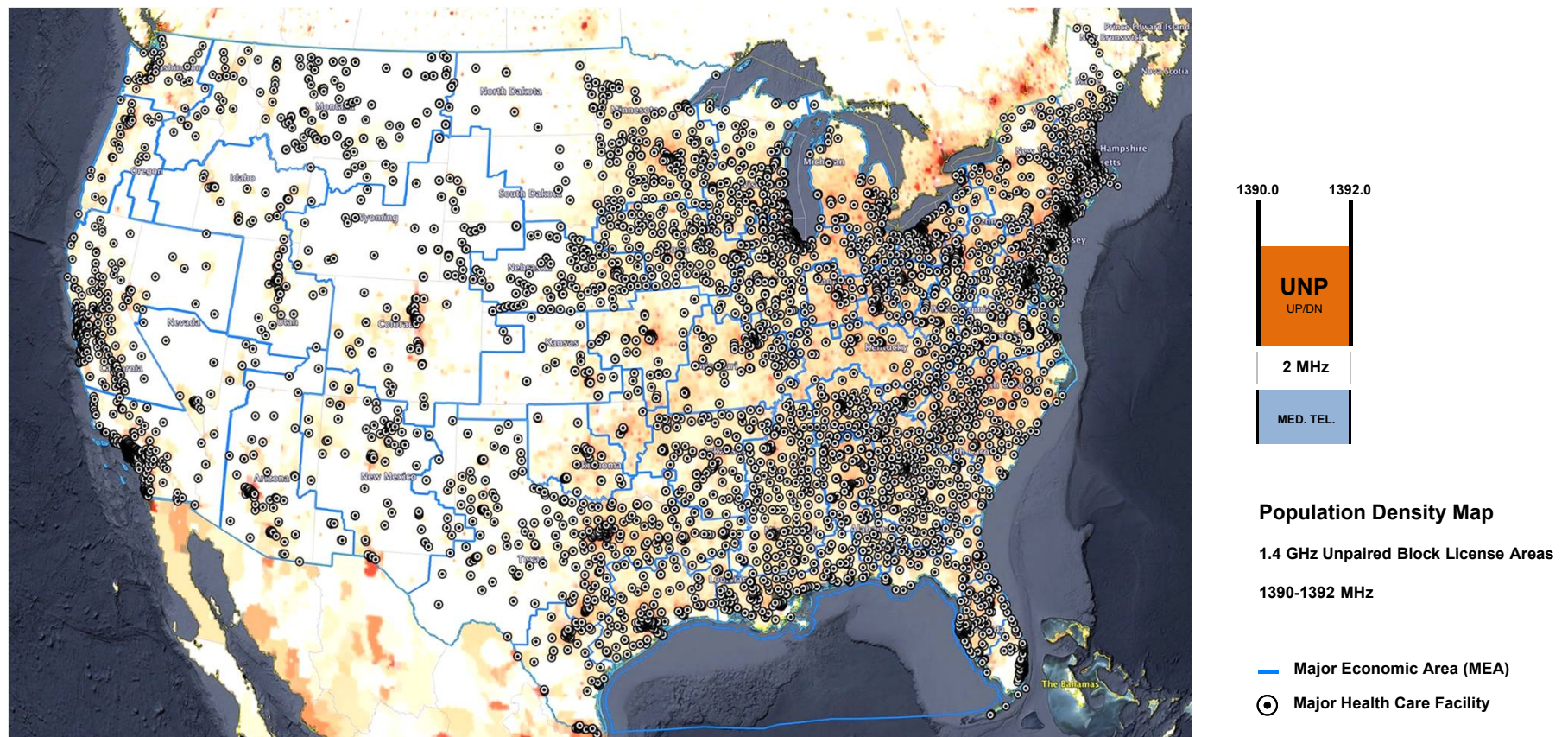
1392-1395 MHz / 1432-1435 MHz

— Economic Area Grouping (EAG)

⊙ Major Health Care Facility

Major Health Care Facility Density Across 1.4 GHz MEAs

Several thousand major health care facilities exist across the 52 MEA license areas applied to the 1.4 GHz Unpaired Block. TerreStar plans to utilize this 2 MHz block in a manner similar to existing Part 95 1.4 GHz WMTS operations. Given the emissions rules applied to commercial 1.4 GHz, TerreStar believes that this band segment alone will effectively double the existing upper 1.4 GHz WMTS “flip band” capacity.

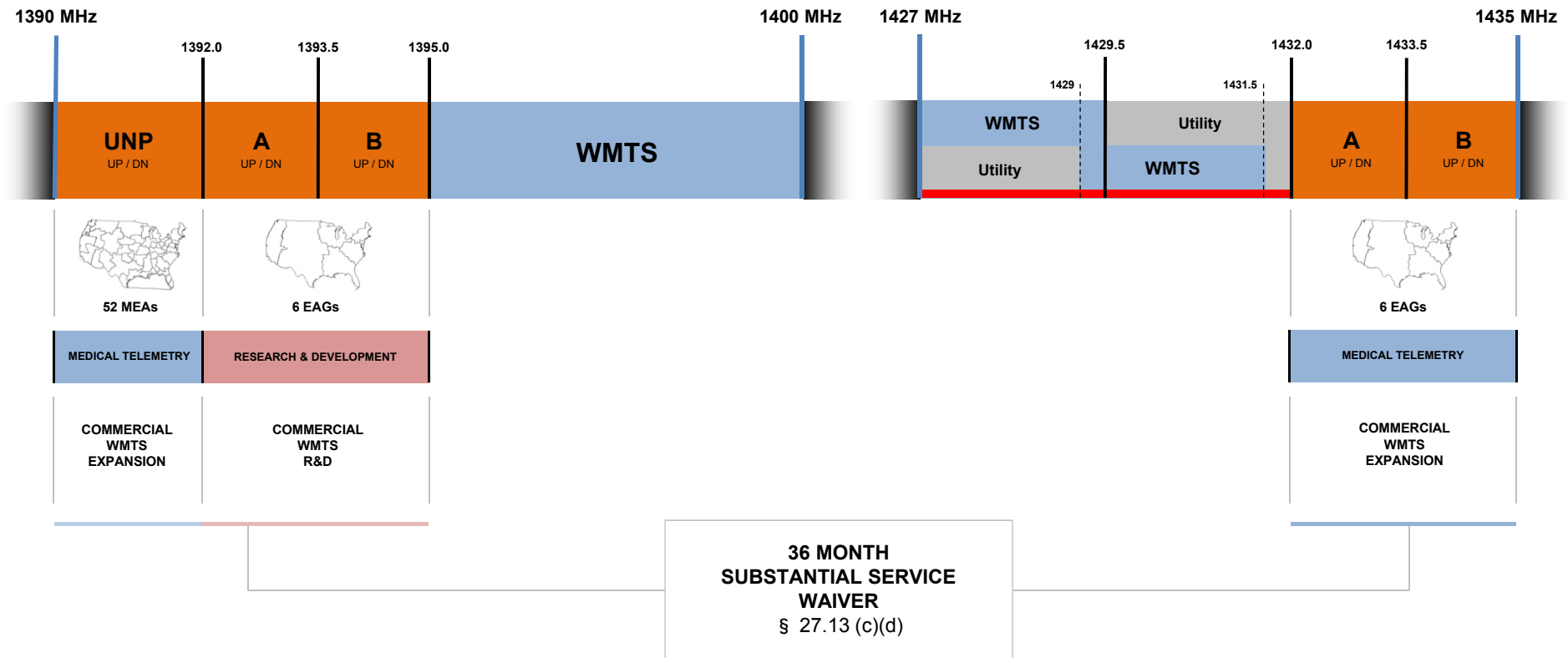


Section IV

Substantial Service Waiver for Commercial Medical Telemetry

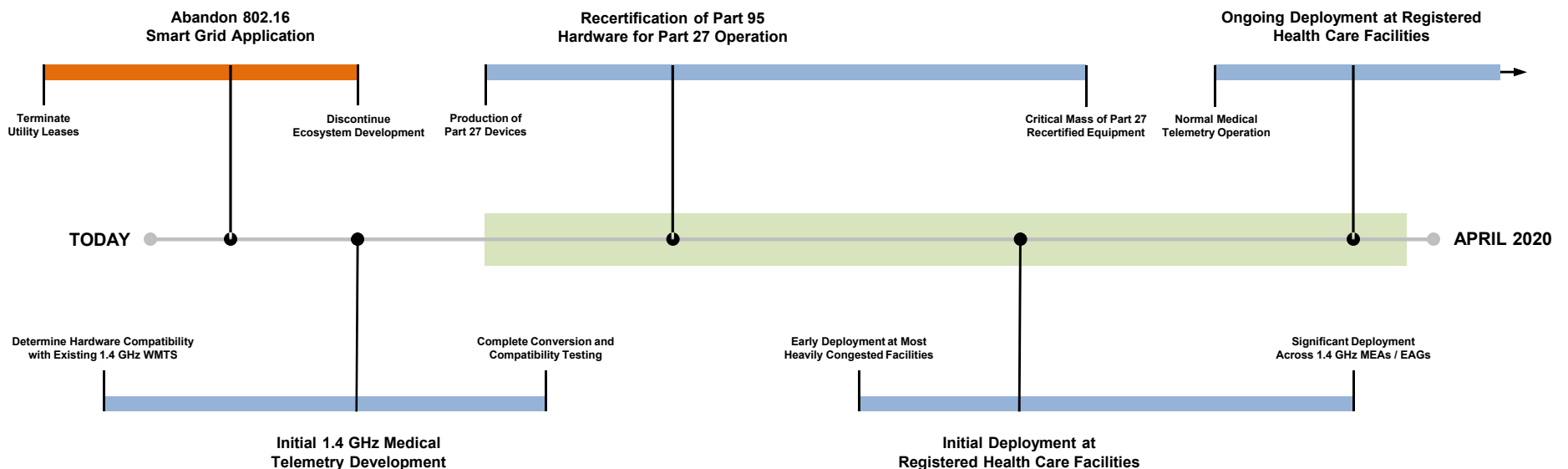
Substantial Service Waiver Request

Use of commercial 1.4 GHz for medical telemetry application represents a significant public interest benefit. Through the proposed service, life-critical medical telemetry services will experience (a) protection from harmful interference, (b) a 67% expansion in available capacity, and (c) nationwide access to spectrum for medical telemetry research and development.



Timeline for Commercial Medical Telemetry Deployment

The available ecosystem for commercial medical telemetry at 1.4 GHz removes a significant obstacle to deployment of the new service. However, the life-critical nature of medical telemetry compels special care in the testing and certification of devices. Following a waiver grant, these processes and the installation of medical telemetry in TerreStar's licensed spectrum at US health care facilities would, industry-wide, likely take more than three years to complete.



Conversion of Equipment for Commercial Medical Telemetry

The direct adjacency of commercial 1.4 GHz allocations to the WMTS band suggests that a bulk of existing Part 95 devices will be convertible to Part 27 operation via software definition. While this will permit unusual speed to market, the life-critical nature of medical telemetry applications demands special care in development, testing, and certification of modified Part 95 equipment.

Existing Part 95 WMTS Equipment



INITIAL DEVELOPMENT

PHASE I

12-18 MONTHS

Conversion Study ▶ Test Conversion ▶ Software Definition Protocols

SAFETY AND EFFICACY TESTING

PHASE II

12-18 MONTHS

Prototype Development ▶ Lab Deployment ▶ Test Facility Deployment

PART 27 RECERTIFICATION

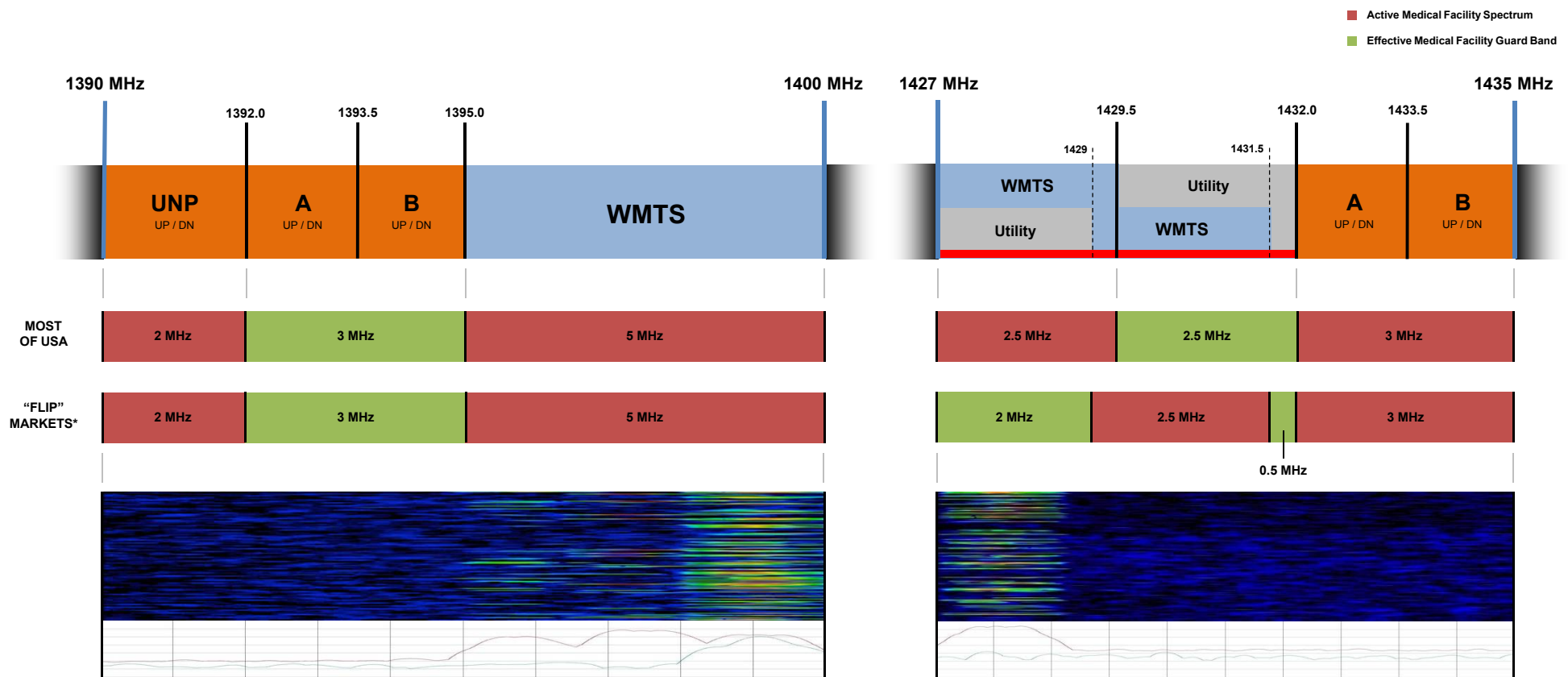
PHASE III

12-18 MONTHS

Compliance Lab Testing ▶ FCC Certification ▶ Commercial Deployment

Compatibility Between Part 27 and Part 95 Medical Telemetry

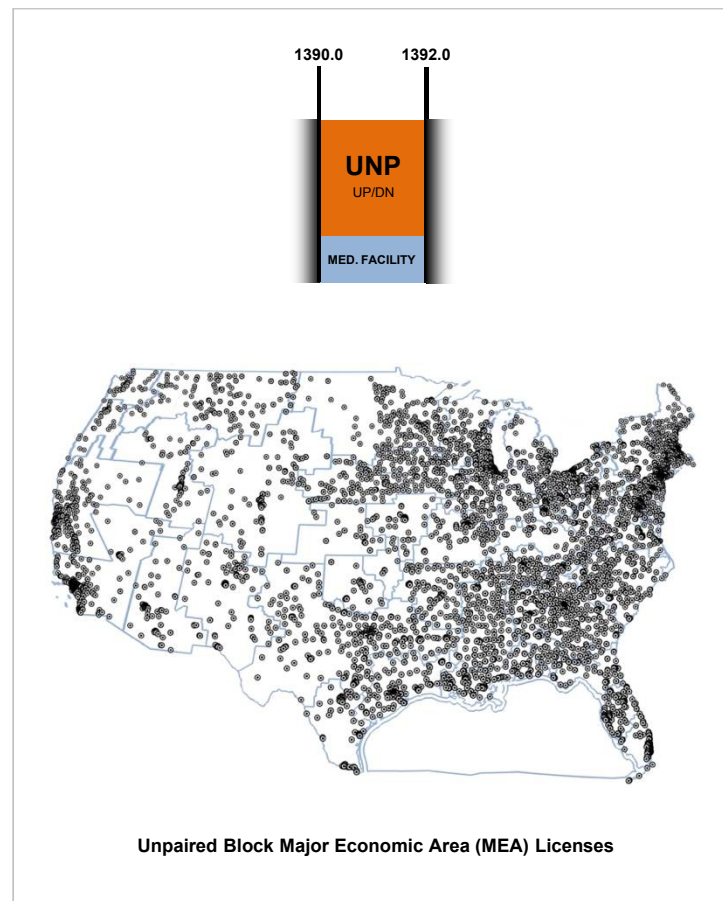
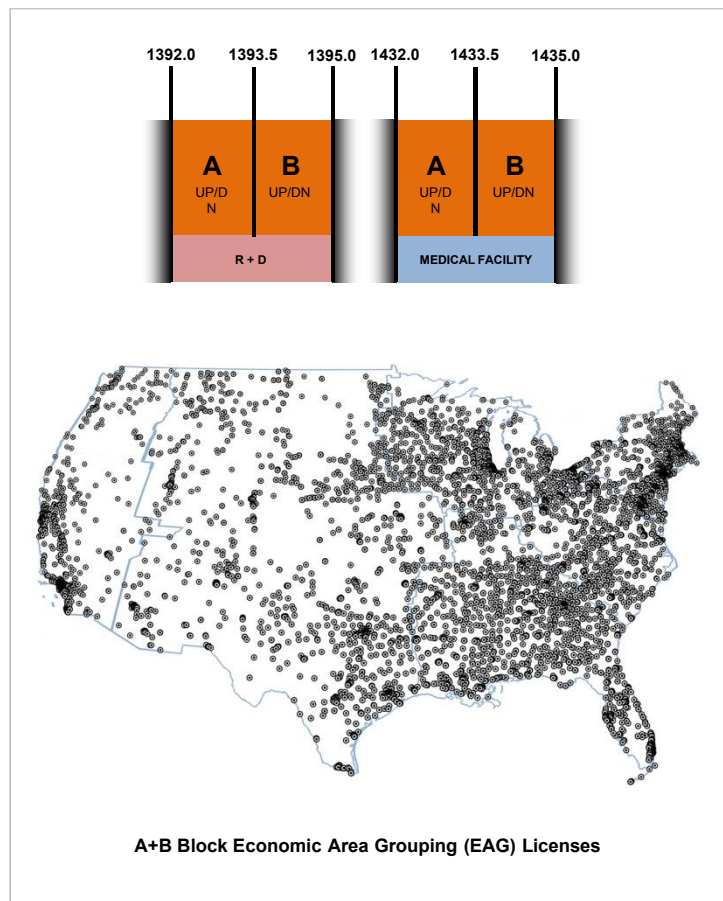
A bulk of existing 1.4 GHz WMTS devices will be readily convertible to commercial 1.4 GHz medical telemetry service in the immediately adjacent band segments. Beyond this hardware compatibility, TerreStar believes that effective channel spacing and liberal Part 27 emissions rules will facilitate both safe co-existence and recertification of equipment for the new service.



*"Flip" markets include Pittsburg, PA, Washington, DC, Richmond, VA, Austin, TX, Battle Creek, MI, Detroit, MI, and Spokane, WA.

Geographic Distribution of Addressable Health Care Facilities

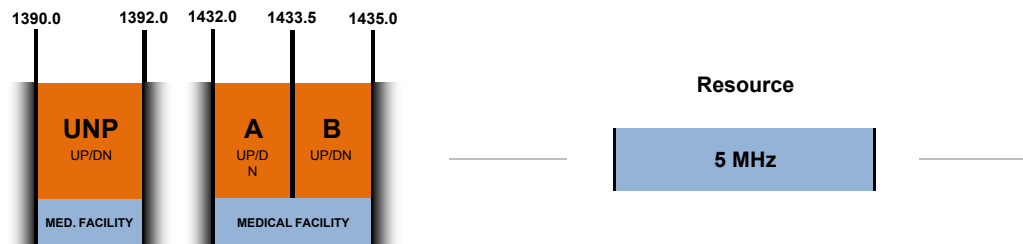
Anticipated rollout of a commercial medical telemetry service is expected to rival the geographic reach of current and planned WMTS systems. These deployments will likely encompass several thousand addressable health care facilities spread across every major population center in the United States. TerreStar anticipates that significant service benefits will be seen in each EAG and MEA license area.



- License Area Boundary
- Major Health Care Facility

Medical Telemetry Applications Across Commercial 1.4 GHz

While the entire 8 MHz commercial 1.4 GHz band is compatible with existing WMTS equipment, only 5 MHz of the resource may be deployed at registered health care facilities (see Part 27.53). TerreStar will use the Unpaired Block and Upper A+B Blocks (5 MHz) for extension of existing WMTS capacity. The Lower A+B Blocks (3 MHz) will be used for wireless medical telemetry applications on an R&D basis.

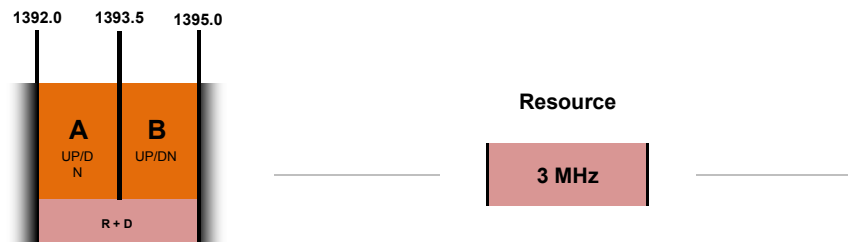


Applications

Part 27 Expansion of 1.4 GHz WMTS Capacity (Providing Service Identical to Existing Part 95 Service)



Health Care Facility
Patient Biometrics



Applications

Part 27 Flexible Rules for New Service Development (Developing Services Exceeding Limitations of Existing Part 95 Service)



Mobile Telemetry
OEM R+D Facilities
Rural Telemedicine